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(71)出願人　000003067
ＴＤＫ株式会社
東京都中央区日本橋１丁目１３番１号
(74)代理人　100076129
弁理士　松山　圭佑
(74)代理人　100080458
弁理士　高矢　諭
(74)代理人　100089015
弁理士　牧野　剛博
(72)発明者　丑田　智樹
東京都中央区日本橋一丁目１３番１号　ティーディーケイ株式会社内
(72)発明者　宇佐美　守
東京都中央区日本橋一丁目１３番１号　ティーディーケイ株式会社内

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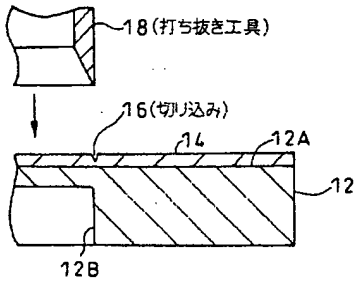
(54)【発明の名称】光記録媒体、光記録媒体の製造方法及び製造装置

(57)【要約】
【課題】光透過層が均一な厚さで基板に形成され、且つ、光透過層の内周部にバリ、剥離が発生しにくい光記録媒体、光記録媒体の製造方法及び製造装置を提供する。
【解決手段】片面が情報記録面１２Ａである円形の基板１２を成形する成形工程と、基板１２よりも薄い光透過層１４を情報記録面１２Ａに形成する光透過層形成工程と、光透過層１４に円形の切り込み１６を形成する切り込み工程と、切り込み１６の内側の領域を打ち抜き工具１８で打ち抜いて光透過層１４及び基板１２に中心孔１４Ａ及び中心孔２０を形成する打ち抜き工程と、を含んでなる製造方法により光記録媒体１０を製造する。
【選択図】　図２



【特許請求の範囲】
【請求項１】
中心孔が形成された円板形状で少なくとも片面が情報記録面とされた基板と、前記情報記録面に前記基板よりも薄く形成され、且つ、前記基板の中心孔よりも内径が大きな中心孔が形成された光透過層と、を含んでなる
ことを特徴とする光記録媒体。
【請求項２】
請求項１において、
前記基板の中心孔の周りに厚さ方向に突出する環状突起が形成されると共に該環状突起の外径よりも内径が大きな中心孔が前記光透過層に形成された
ことを特徴とする光記録媒体。
【請求項３】
請求項２において、
前記環状突起の突出量が前記光透過層の厚さとほぼ等しい
ことを特徴とする光記録媒体。
【請求項４】
少なくとも片面が情報記録面である円板形状の基板を成形する成形工程と、前記情報記録面に前記基板よりも薄い光透過層を形成する光透過層形成工程と、該光透過層に円形の切り込みを形成する切り込み工程と、該切り込みの内側の少なくとも一部の領域を打ち抜き工具で打ち抜いて前記光透過層及び前記基板に中心孔を形成する打ち抜き工程と、を含んでなる
ことを特徴とする光記録媒体の製造方法。
【請求項５】
請求項４において、
前記光透過層の切り込みを前記基板の中心孔の内径よりも大きな直径で形成し、該切り込みよりも内側の領域を前記打ち抜き工具で厚さ方向に加圧して前記光透過層を前記切り込みにおいて分割しつつ前記光透過層及び前記基板を打ち抜くことにより前記基板の中心孔よりも内径が大きな中心孔を前記光透過層に形成する
ことを特徴とする光記録媒体の製造方法。
【請求項６】
請求項５において、
前記成形工程で前記基板の中心孔の内径よりも大きな外径の円形突起を前記情報記録面に成形し、前記円形突起の外周の外側に沿って前記光透過層に前記切り込みを形成し、前記打ち抜き工具で前記円形突起の外周部を残して前記基板を打ち抜くことにより前記基板の中心孔の周りに環状突起を形成すると共に該環状突起の外径よりも内径が大きな中心孔を前記光透過層に形成する
ことを特徴とする光記録媒体の製造方法。
【請求項７】
請求項４～６のいずれかにおいて、
前記光透過層形成工程で前記基板の中心近傍に流動性を有する樹脂を供給すると共に該基板を回転させ、前記樹脂を遠心力で径方向外側に流動させて展延することにより前記光透過層を形成する
ことを特徴とする光記録媒体の製造方法。
【請求項８】
請求項７において、
前記光透過層の材質を放射線硬化性樹脂として前記光透過層形成工程で前記光透過層が半硬化状態となるように放射線を照射し、
前記切り込み工程の後に前記半硬化状態の光透過層に放射線を再照射して完全に硬化させる再照射工程を設けた
ことを特徴とする光記録媒体の製造方法。

【請求項９】
少なくとも片面が情報記録面である円板形状の基板に該基板よりも薄い光透過層を前記情報記録面に形成してなる光記録媒体の半完成品の前記光透過層に円形の切り込みを形成する切り込み手段と、前記切り込みの内側の少なくとも一部の領域を打ち抜き工具で打ち抜いて前記光透過層及び前記基板に中心孔を形成する打ち抜き手段と、を含んでなる
ことを特徴とする光記録媒体の製造装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、基板よりも薄い光透過層が基板の情報記録面に形成され、且つ、中心孔が形成された光記録媒体、光記録媒体の製造方法及び製造装置に関する。
【０００２】
【従来の技術】
近年、情報記録媒体としてＣＤ（Ｃｏｍｐａｃｔ　Ｄｉｓｃ）、ＤＶＤ（Ｄｉｇｉｔａｌ　Ｖｅｒｓａｔｉｌｅ　Ｄｉｓｃ）等の光記録媒体が急速に普及している。光記録媒体は一般的に外径が１２０ｍｍ、厚さが１．２ｍｍに統一されているが、ＤＶＤは照射光としてＣＤよりも波長が短いレーザー光を用いると共に、照射光のレンズの開口数をＣＤよりも大きくすることでＣＤよりも高密度で大容量の情報を記録・再生できるようにされている。
【０００３】
一方、照射光の波長が短く、レンズの開口数が大きいほどディスクの傾き（反り）によりコマ収差が発生して情報の記録・再生精度が低下する傾向があるため、ＤＶＤは光透過層の厚さをＣＤの半分の０．６ｍｍとすることで、ディスクの傾き（反り）に対するマージンを確保し、情報の記録・再生精度を維持している。
【０００４】
尚、０．６ｍｍの光透過層のみでは剛性、強度が不充分であるため、ＤＶＤは、０．６ｍｍの基板を２枚、情報記録面を内側にして貼り合わせた構造とされ、厚さがＣＤと等しい１、２ｍｍとされ、ＣＤと同等の剛性、強度が確保されている。
【０００５】
又、光記録媒体には一般的に中心孔（例えば、ＣＤ、ＤＶＤではϕ１５ｍｍ）が形成され、記録・再生装置等における位置決め等のために使用されている。中心孔は一般的に、基板を円板形状に成形する成形工程で同時に成形される。
【０００６】
ここで、一層高密度で大容量の情報の記録を実現すべく、更に照射光の波長を短かくすると共にレンズの開口数を大きくしたいという要請がある。この要請に対し、光透過層を一層薄くした光記録媒体が求められており、構造材としての基板の情報記録面に基板よりも薄い光透過層を形成して合計の厚さを１．２ｍｍとする光記録媒体の開発が進められている。尚、仕様を統一すべく、照射光として波長が４０５ｎｍの青紫色のレーザー光を用いると共に開口数を０．８５とし、これに対応して光透過層の厚さを０．１ｍｍとする提案がなされている。
【０００７】
図１８は、このような薄い光透過層が形成された光記録媒体の構造を示す斜視図である。
【０００８】
光記録媒体１００は、基板１０２の情報記録面１０２Ａに基板１０２よりも薄い光透過層１０４が形成された構造で片面のみに情報を記録可能である片面タイプである。
【０００９】
基板１０２は、直径が１２０ｍｍ、厚さが１．１ｍｍで一般的に量産性に優れた射出成形により成形される。具体的には、ポリカーボネート等の樹脂が一対の型の間に射出されて所定の温度に冷却、保温され、円板形状に成形される。
【００１０】

光透過層１０４は、厚さが０．１ｍｍで基板１０２の情報記録面１０２Ａにスピンコート法等により形成される。具体的には、紫外線硬化性又は電子線硬化性の光透過性の樹脂を情報記録面１０２Ａの中心近傍に供給し、基板１０２を回転させて、供給した樹脂を遠心力で径方向外側に付勢し、流動させることにより情報記録面１０２Ａの全面に展延する。展延後、紫外線、電子線等を照射し、樹脂を硬化させて光透過層形成工程が完了する。尚、基板の両面に情報を記録可能である両面タイプの場合は、基板の厚さを１．０ｍｍとし、基板の両面それぞれに０．１ｍｍの光透過層を積層すればよい。あるいは、厚さが０．５ｍｍの基板に厚さが０．１ｍｍの光透過層を積層したものを２枚用意し、基板側同士を貼り合わせてもよい。

【００１１】

【発明が解決しようとする課題】

しかしながら、中心孔が形成された基板にスピンコート法を適用すると、展延した樹脂の厚さが不均一となりやすく、高密度な情報の記録、再生が困難となることがある。

【００１２】

厚さが不均一になる理由は必ずしも明らかではないが、概ね次のように考えられている。樹脂を中心孔の周囲に供給すると基板の回転により樹脂に直ちに遠心力が作用し、供給された位置よりも径方向の外側に流動しながら、供給位置よりも外側の基板全体へと展延される。この間常に遠心力が作用し続けるため、内側と外側の膜厚は均一にはならず、内側ほど薄く、外側ほど厚いという膜厚分布となる。又、膜厚が薄くなることを補う目的で樹脂を追加的に供給することも考えられるが、厚みのばらつきに応じた高精度の制御が必要となり、このような制御は実際上困難である。

【００１３】

これに対して、中心孔がない基板であれば、樹脂を基板の中心部に、あるいは中心孔がある場合よりも径方向の内側に供給することができ、供給した樹脂に直ちに遠心力が作用することを防止することができる。この場合、基板の中心部が樹脂溜まりのような役割を果たし、情報記録面上に連続的に樹脂を追加供給するため、樹脂を均一な厚さで展延することが可能である。この場合、展延した樹脂を硬化させてから、図１９に示されるように光透過層１０４及び基板１０２を打ち抜き工具１０６で打ち抜いて中心孔を形成することになる。尚、図中の符号１０２Ａは打ち抜きを容易にするために基板１０２の情報記録面１０２Ａと反対側の面に成形した円形の凹部である。

【００１４】

しかしながら、光透過層１０４は厚さが約０．１ｍｍの極めて薄い層であるため、打ち抜き工具１０６で打ち抜く際、図２０に示されるように内周部にバリが発生したり、内周部が情報記録面１０２Ａから剥離することがあるという問題がある。又、製造段階でバリ、剥離が発生しなくても、使用時に中心孔に指等を挿入すると光透過層の内周部に指等が触れて光透過層が剥離することもある。

【００１５】

本発明は、以上の問題点に鑑みてなされたものであって、光透過層が均一な厚さで基板に形成された、且つ、光透過層の内周部にバリ、剥離が発生しにくい光記録媒体、光記録媒体の製造方法及び製造装置を提供することをその課題とする。

【００１６】

【課題を解決するための手段】

上記の課題を解決するために、本発明者は鋭意検討した結果、光透過層に円形の切り込みを形成し、該切り込みの内側の少なくとも一部の領域を打ち抜き工具で打ち抜いて光透過層及び円形基板に中心孔を形成することにより、中心孔を有する光透過層を均一な厚さで確実に基板に形成することができることを見出した。

【００１７】

即ち、以下の発明により上記課題を解決することができる。

【００１８】

（１）中心孔が形成された円板形状で少なくとも片面が情報記録面とされた基板と、前記

情報記録面に前記基板よりも薄く形成され、且つ、前記基板の中心孔よりも内径が大きな中心孔が形成された光透過層と、を含んでなることを特徴とする光記録媒体。

【００１９】

（２）前記基板の中心孔の周りに厚さ方向に突出する環状突起が形成されると共に該環状突起の外径よりも内径が大きな中心孔が前記光透過層に形成されたことを特徴とする（１）の光記録媒体。

【００２０】

（３）前記環状突起の突出量が前記光透過層の厚さとほぼ等しいことを特徴とする（２）の光記録媒体。

【００２１】

（４）少なくとも片面が情報記録面である円板形状の基板を成形する成形工程と、前記情報記録面に前記基板よりも薄い光透過層を形成する光透過層形成工程と、該光透過層に円形の切り込みを形成する切り込み工程と、該切り込みの内側の少なくとも一部の領域を打ち抜き工具で打ち抜いて前記光透過層及び前記基板に中心孔を形成する打ち抜き工程と、を含んでなることを特徴とする光記録媒体の製造方法。

【００２２】

（５）前記光透過層の切り込みを前記基板の中心孔の内径よりも大きな直径で形成し、該切り込みよりも内側の領域を前記打ち抜き工具で厚さ方向に加圧して前記光透過層を前記切り込みにおいて分割しつつ前記光透過層及び前記基板を打ち抜くことにより前記基板の中心孔よりも内径が大きな中心孔を前記光透過層に形成することを特徴とする（４）の光記録媒体の製造方法。

【００２３】

（６）前記成形工程で前記基板の中心孔の内径よりも大きな外径の円形突起を前記情報記録面に成形し、前記円形突起の外周の外側に沿って前記光透過層に前記切り込みを形成し、前記打ち抜き工具で前記円形突起の外周部を残して前記基板を打ち抜くことにより前記基板の中心孔の周りに環状突起を形成すると共に該環状突起の外径よりも内径が大きな中心孔を前記光透過層に形成することを特徴とする（５）の光記録媒体の製造方法。

【００２４】

（７）前記光透過層形成工程で前記基板の中心近傍に流動性を有する樹脂を供給すると共に該基板を回転させ、前記樹脂を遠心力で径方向外側に流動させて展延することにより前記光透過層を形成することを特徴とする（４）～（６）のいずれかの光記録媒体の製造方法。

【００２５】

（８）前記光透過層の材質を放射線硬化性樹脂として前記光透過層形成工程で前記光透過層が半硬化状態となるように放射線を照射し、前記切り込み工程の後に前記半硬化状態の光透過層に放射線を再照射して完全に硬化させる再照射工程を設けたことを特徴とする（７）の光記録媒体の製造方法。

【００２６】

（９）少なくとも片面が情報記録面である円板形状の基板を成形する成形手段と、該基板よりも薄い光透過層を前記情報記録面に形成する光透過層形成手段と、該光透過層に円形の切り込みを形成する切り込み手段と、前記切り込みの内側の少なくとも一部の領域を打ち抜き工具で打ち抜いて前記光透過層及び前記基板に中心孔を形成する打ち抜き手段と、を含んでなることを特徴とする光記録媒体の製造装置。

【００２７】

（１０）前記環状突起の突出量が前記光透過層の厚さよりも大きいことを特徴とする（２）の光記録媒体。

【００２８】

尚、光透過層の中心孔の内径と光透過層を打ち抜く打ち抜き工具の外径とは必ずしも一致しない。例えば、上記（５）のように基板の中心孔の内径よりも大きな直径の切り込みを形成する場合、基板に形成しようとする中心孔の内側と等しい外径の打ち抜き工具が使用

される。光透過層は打ち抜き工具に加圧されて打ち抜き工具の外周よりも径方向外側の切り込みで分割される。切り込みよりも径方向内側部分は打ち抜き工具よりも径方向外側の部分も含めて打ち抜き工具で更に厚さ方向に押し出されて光記録媒体から取り除かれる。即ち、光透過層の中心孔は打ち抜き工具の外径よりも大きな内径で形成される。一方、基板の中心孔の内径と等しい直径で切り込みを形成すれば光透過層の中心孔の内径と打ち抜き工具の外径とが一致することとなる。

【００２９】

又、「放射線」という用語は一般的には放射性元素の崩壊に伴って放出される、γ線、Ｘ線、α線等の電磁波、粒子線を意味するが本明細書においては、「放射線」という用語は、例えば紫外線、電子線等、流動状態の特定の樹脂を硬化させる性質を有する電磁波、粒子線の総称という意義で用いることとする。

【００３０】

【発明の実施の形態】

以下、本発明の実施形態について図面を参照して詳細に説明する。

【００３１】

図１は本実施形態に係る光記録媒体１０の断面図である。図２は光記録媒体１０の製造時における打ち抜き工程を示す断面図である。

【００３２】

光記録媒体１０の製造方法は、片面が情報記録面１２Ａである円板形状の基板１２を成形する成形工程と、情報記録面１２Ａに基板１２よりも薄い光透過層１４を形成する光透過層形成工程と、光透過層１４に円形の切り込み１６を形成する切り込み工程と、切り込み１６の内側の領域を打ち抜き工具１８で打ち抜いて光透過層１４及び基板１２に中心孔１４Ａ及び中心孔２０を形成する打ち抜き工程と、を含んでなることを特徴としている。

【００３３】

他の工程については、従来の光記録媒体の製造方法と同様であるので説明を適宜省略する。

【００３４】

まず、基板１２の成形工程について説明する。

【００３５】

一対の型（図示省略）の間に予め加熱して溶融しておいたポリカーボネート等の樹脂を射出して所定の成形温度に冷却・保温し、直径が１２０ｍｍ、厚さが１．１ｍｍで情報記録面１２Ａに中心孔が無い円板形状に成形する。この際、スタンパ（図示省略）により情報記録面１２Ａに所定の微細な凹凸等（図示省略）を形成する（図３参照）。ポリカーボネートに代えてアクリル、エポキシ等の樹脂を用いてもよい。尚、図中の符号１２Ｂは後述する打ち抜き工程で基板１２を打ち抜きやすくするために情報記録面１２Ａと反対側の面に成形した円形の凹部であり、内径が（後に形成する）中心孔２０の内径と等しく成形されている。このように基板１２を成形して型から取り外して常温に冷却し、次工程で情報記録面１２Ａに機能層を形成する。

【００３６】

ここで、機能層の形成工程について簡単に説明しておく。尚、機能層は光透過層１４よりも更に薄い層であると共に本発明の把握のために特に必要とは思われないため機能層の図示は省略する。光記録媒体１０が再生専用タイプの場合、情報記録面１２Ａに機能層として反射層を形成する。一方、光記録媒体１０が情報を記録・再生可能なタイプである場合、情報記録面１２Ａに機能層として反射層、記録層をこの順で形成する。反射層はＡｌ、Ａｇ、Ａｕ等からなり、スパッタリング法、蒸着法等により形成する。記録層は相変化材料、色素材料、光磁気材料等からなり、スパッタリング法、スピンコート法、リッピング法、蒸着法等により形成する。

【００３７】

次に、光透過層形成工程について説明する。

【００３８】

光透過層１４は、スピンコート法により機能層の上に形成する。

【００３９】

まず、基板１２を水平に配置して回転駆動し、図４に示されるように基板１２の中心部に紫外線硬化性の樹脂２１を上方から所定量供給する。樹脂２１には、基板１２の中心からの距離に比例した遠心力が作用し、これにより樹脂２１は径方向外側に付勢されて情報記録面１２Ａ全体に展延される。この際、中心近傍の樹脂２１には、遠心力がほとんど作用しないため、基板１２の中心部が樹脂溜りのような役割を果たし、情報記録面１２Ａ上に連続的に樹脂２１を追加供給する。これにより、情報記録面１２Ａ全体に図５に示されるように均一な厚さで樹脂２１が展延される。展延後、樹脂２１に紫外線を照射して硬化させることにより光透過層形成工程が完了する。

【００４０】

次に、切り込み工程について説明する。

【００４１】

まず、図６に示されるように工具２２の刃部２２Ａを、光透過層１４の所定の位置に当接させる。具体的には、後に形成する中心孔２０の内周に対応する位置に刃部２２Ａを当接させる。この状態で、図７に示されるように基板１２と共に光透過層１４を回転させると、光透過層１４に円形の切り込み１６が同心状に形成される。切り込み１６の深さは、光透過層１４の厚さよりも浅くしてもよく、光透過層１４の厚さと等しくしてもよい。又、光透過層１４の厚さよりも深くして、基板１２まで切り込むようにしてもよい。

【００４２】

次に、打ち抜き工程について説明する。

【００４３】

まず、形成しようとする中心孔２０の内径と等しい外径の円形の打ち抜き工具１８を用意し、図２に示されるように打ち抜き工具１８の外周が切り込み１６に一致するように打ち抜き工具１８を光透過層１４に同心状に対向させる。次に、打ち抜き工具１８を該光透過層１４の方向に付勢し、光透過層１４及び基板１２を打ち抜き工具１８で打ち抜いて図１に示されるように光透過層１４に中心孔１４Ａを形成すると共に基板１２に中心孔２０を形成する。尚、中心孔１４Ａと中心孔２０は内径が等しい。

【００４４】

この際、光透過層には打ち抜き工程に先立って切り込み工程による切り込みが形成されており、且つ、光透過層１４の切り込み１６の部分に応力が集中して光透過層１４は切り込み１６の部分で正確に分割されるので、光透過層１４の内周部にバリが発生したり、内周部が情報記録面１２Ａから剥離することがない。

【００４５】

以上により光記録媒体１０が完成する。光記録媒体１０は、光透過層１４の厚さが均一であるため、高密度な情報を正確に記録、再生することができると共に内周部が情報記録面１２Ａに確実に密着して剥離しにくく、信頼性が高い。

【００４６】

尚、基板１２の中心孔２０、光透過層１４の中心孔１４Ａは円形で光記録媒体１０に同心状に形成されているが、中心孔２０、１４Ａの真円の精度、同心の精度は光記録媒体に要求される寸法公差内であればよく、厳密な真円形状から若干外れた円形、厳密な同心状態からの若干の偏心は当然許容される。

【００４７】

次に、本発明の第２実施形態について説明する。

【００４８】

図８は、本第２実施形態に係る光記録媒体３０の構造を示す断面図である。

【００４９】

光記録媒体３０は、光透過層１４に基板１２の中心孔２０よりも内径が大きな中心孔１４Ａが形成されたことを特徴としている。

【００５０】

又、光記録媒体３０の製造方法は、図９に示されるように、光透過層１４の切り込み１６を基板１２の中心孔２０の内径よりも大きな直径で形成し、切り込み１６よりも内側の領域を打ち抜き工具１８で厚さ方向に加圧して光透過層１４を切り込み１６において分割しつつ光透過層１４及び基板１２を打ち抜くことにより基板１２の中心孔２０よりも内径が大きな中心孔１４Ａを光透過層１４に形成することを特徴としている。

【００５１】

その他の点については、前記光記録媒体１０及び光記録媒体１０の製造方法と同様であるので説明を適宜省略する。

【００５２】

まず、切り込み工程について説明する。

【００５３】

図１０に示されるように、後に基板１２に形成する中心孔２０の内周に対応する位置よりも若干径方向の外側の位置で工具２２の刃部２２Ａを光透過層１４に当接させ、この状態で、基板１２と共に光透過層１４を回転させる。これにより、光透過層１４に円形の切り込み１６が、後に基板１２に形成する中心孔２０の内径よりも若干大きな直径で同心状に形成される。

【００５４】

次に、打ち抜き工程について説明する。

【００５５】

図９に示されるように、まず、打ち抜き工具１８の外周が基板１２に形成しようとする中心孔２０の内周と一致するように打ち抜き工具１８を光透過層１４に対向させる。次に、打ち抜き工具１８を光透過層１４の方向に付勢し、光透過層１４及び基板１２を打ち抜き工具１８で打ち抜いて図８に示されるような中心孔２０を基板１２に形成する。

【００５６】

この際、打ち抜き工具１８は、光透過層１４における切り込み１６よりも内側の領域を基板１２側に加圧して光透過層１４を切り込み１６において分割し、切り込み１６の内側部分を基板１２側に押し出すようにして打ち抜く。

【００５７】

尚、光透過層１４における切り込み１６の直径は基板１２の中心孔２０の内径よりも大きいが切り込み１６の内側部分は打ち抜き工具１８で厚さ方向に押し出されて基板１２の中心孔２０を形成しつつ該中心孔２０を挿通して取り除かれる。又、打ち抜き工具の刃部外周面に、切り込みより内側で打ち抜き工具より外側の光透過層（リング状）が入り込むことのできる凹部（逃げ部）１８Ａを設け、当該部分の光透過層を効率よく取り除くことができるようにしてもよい。

【００５８】

これにより、光透過層１４に基板１２の中心孔２０よりも内径が大きい中心孔１４Ａが形成される。

【００５９】

尚、この場合も、光透過層には打ち抜き工程に先立って切り込み工程による切り込みが形成されており、且つ、光透過層１４の切り込み１６の部分に応力が集中し、光透過層１４は切り込み１６の部分で正確に分割されるので、光透過層１４の内周部にバリが発生したり、内周部が情報記録面１２Ａから剥離することがない。

【００６０】

このように光透過層１４の中心孔１４Ａを基板１２の中心孔２０よりも大きくすることで、中心孔２０に指を挿入しても、光透過層１４の内周部に指が直接触れにくくなり、人的な取り扱いによる光透過層１４の剥離も防止することができる。

【００６１】

同様に、光記録媒体３０を情報記録装置、情報再生装置等に装填する場合にも、光透過層１４の内周部に位置決め等のための部品が接触することがなく、これらの装置で使用する際の光透過層１４の剥離も防止することができる。

【００６２】
又、基板１２の中心孔２０の内径と、光透過層１４の中心孔１４Ａの内径とに差があるにも拘らず、切り込み１６を形成することで、打ち抜き工具１８による１回のみの打ち抜きで２つの中心孔２０、１４Ａを形成することができ、生産効率が良い。
【００６３】
尚、前記第１実施形態と同様に基板１２の中心孔２０の真円の精度、光記録媒体３０に対する同心の精度は光記録媒体３０に要求される寸法公差内であればよく、厳密な真円から若干外れた円形、厳密な同心状態からの若干の偏心は当然許容される。
【００６４】
又、光透過層１４の中心孔１４Ａは内周が基板１２の中心孔２０よりも径方向外側に位置するように形成されていればよく、光透過層１４の中心孔１４Ａに要求される真円の精度、光記録媒体３０に対する同心の精度は基板１２の中心孔２０に要求される精度よりも低く、必ずしも基板１２の中心孔２０と同心である必要はない。即ち、切り込み１６の形成に要求される精度が低く、それだけ切り込み作業が容易である。又、打ち抜き工具１８は、基板１２に形成しようとする中心孔２０に一致するように切り込み１６よりも内側の領域を打ち抜けばよく、打ち抜きの際に打ち抜き工具１８と切り込み１６とが必ずしも同心状態である必要もない。
【００６５】
次に、本発明の第３実施形態について説明する。
【００６６】
図１１は、本第３実施形態に係る光記録媒体４０の構造を示す断面図である。
【００６７】
光記録媒体４０は、基板４２の中心孔５０の周りに厚さ方向に突出する環状突起４８が形成されると共に環状突起４８の外径よりも内径が大きな中心孔４４Ａが光透過層４４に形成されたことを特徴としている。
【００６８】
又、図１２に示されるように、光記録媒体４０の製造方法は、成形工程で後に形成する基板４２の中心孔５０の内径よりも大きな外径の円形突起４３を情報記録面４２Ａに成形し、円形突起４３の外周の外側に沿って光透過層４４に切り込み４６を形成し、打ち抜き工具１８で円形突起４３の外周部を残して基板４２を打ち抜くことにより基板４２に中心孔５０及び中心孔５０の周りに環状突起４８を形成すると共に該環状突起４８の外径よりも内径が大きな中心孔４４Ａを光透過層４４に形成することを特徴としている。
【００６９】
その他の点については、前記光記録媒体１０、３０及びこれら光記録媒体の製造方法と同様であるので説明を適宜省略する。
【００７０】
まず、基板４２の成形工程について説明する。
【００７１】
基板４２を成形する一対の型（図示省略）のうち、情報記録面４２Ａを成形する型の中心部に円形の凹部を設けておくことにより、基板４２の情報記録面４２Ａ側に図１３に示されるような円形突起４３を形成する。円形突起４３は、後に形成する中心孔５０の内径よりも若干大きな外径となるように同心状に成形する。尚、基板４２は、円形突起４３以外の部分の厚さが１．１ｍｍ、円形突起４３の突出量が０．１ｍｍとなるように成形する。又、基板４２の情報記録面４２Ａと反対側の面を成形する型の中心部には円形の突起を設けておき、基板４２の情報記録面４２Ａと反対側に円形の凹部４２Ｂを同心状に成形する。尚、円形の凹部４２Ｂは内径が、後に形成する中心孔５０の内径と等しくなるように成形する。
【００７２】
次に、光透過層４４の形成工程について説明する。
【００７３】

まず、基板４２を水平に配置して回転駆動し、該基板４２の中心部に紫外線硬化性樹脂を上方から所定量供給する。供給した樹脂には、基板４２の中心からの距離に比例した遠心力が作用し、径方向外側に付勢されて情報記録面４２Ａ全体に展延される。この際、回転中心近傍の樹脂には、遠心力がほとんど作用しないため、基板４２の中心部が樹脂溜りのような役割を果たし、情報記録面４２Ａ上に連続的に樹脂を追加供給する。これにより、図１４に示されるように情報記録面４２Ａ全体に均一な厚さで樹脂が展延される。尚、円形突起４３上にも樹脂は均一な厚さで展延されるため、光透過層４４は段付状に形成される。展延後、樹脂に紫外線を照射して硬化させて光透過層４４の形成工程が完了する。

【００７４】

次に、切り込み工程について説明する。

【００７５】

図１５に示されるように、切り込み４６は、円形突起４３の外周の外側に沿うように光透過層４４の段差部分の近傍に形成する。尚、切り込み４６を形成する工具等については前記第１及び第２実施形態と同じであるので説明を省略する。

【００７６】

次に、打ち抜き工程について説明する。

【００７７】

まず、図１２に示されるように、打ち抜き工具１８の外周が形成しようとする中心孔５０の内周と一致するように打ち抜き工具１８を光透過層４４に対向させる。次に、打ち抜き工具１８を光透過層４４の方向に付勢し、外周部を残して円形突起４３を打ち抜き、図１１に示されるような、中心孔５０を形成すると共に、円形突起４３の一部を残して中心孔５０の周りに環状突起４８を形成する。

【００７８】

この際、打ち抜き工具１８は、円形突起４３上の光透過層４４を厚さ方向に加圧して切り込み４６において分割し、切り込み４６の内側部分を基板４２側に押し出すように打ち抜く。これにより、環状突起４８の外径よりも内径が大きな中心孔４４Ａが光透過層４４に形成される。

【００７９】

この場合も、光透過層には打ち抜き工程に先立って切り込み工程による切り込みが形成されており、且つ、光透過層４４の切り込み４６の部分に応力が集中し、光透過層４４は切り込み４６の部分で正確に分割されるので、光透過層４４の内周部にバリが発生したり、内周部が情報記録面４２Ａから剥離することがない。

【００８０】

即ち、光記録媒体４０は、前記光記録媒体１０及び３０と同様に光透過層４４の厚さが均一で情報を正確に記録・再生することができると共に、光透過層４４の内周部が情報記録面４２Ａに確実に密着して剥離しにくく、信頼性が高い。

【００８１】

更に、光透過層４４の内周部の内側に環状突起４８が形成されているので、中心孔５０に指を挿入しても、光透過層４４の内周部に指が直接触れることがなく、人的な取り扱いによる光透過層４４の剥離も確実に防止することができる。

【００８２】

同様に、光記録媒体４０を情報記録装置、情報再生装置等に装填する場合にも、光透過層４４の内周部に位置決め等のための部品が接触することがなく、これらの装置等で使用する際の光透過層４４の剥離も確実に防止することができる。

【００８３】

即ち、光透過層４４の内周部が環状突起４８で保護されるので、光透過層４４の剥離を確実に防止することができる。

【００８４】

又、基板４２の中心孔５０の内径と光透過層４４の中心孔４４Ａの内径とに差があるにも拘らず、切り込み４６を形成することで、打ち抜き工具１８による１回のみの打ち抜きで

２つの中心孔５０、４４Ａ及び環状突起４８を形成することができ、生産効率が良い。

【００８５】

尚、環状突起４８は、基板４２の中心孔５０の周りで厚さ方向に突出していればよく、径方向の幅が必ずしも一定である必要はない。即ち、環状突起４８の外周が光記録媒体４０と同心の円形である必要はない。従って、基板４２の成形工程において円形突起４３を若干偏心させて形成してもよい。

【００８６】

又、光透過層４４の中心孔４４Ａは内周が環状突起４８よりも径方向外側に位置するように形成されていればよく、光記録媒体４０と同心の円形である必要はない。従って切り込み工程でも光透過層４４に若干偏心した切り込みを形成してもよい。

【００８７】

又、前記第１～第３実施形態において、光記録媒体は片面のみに情報を記録可能である片面タイプとされているが、本発明はこれに限定されるものではなく、両面に情報を記録可能である両面タイプの光記録媒体に対しても本発明は当然適用可能である。この場合、基板の厚さを１．０ｍｍとし、基板の両面に０．１ｍｍの光透過層を積層することで、厚さが１．２ｍｍの光記録媒体とすることができる。あるいは、厚さが０．５ｍｍの基板に厚さが０．１ｍｍの光透過層を積層したものを２枚用意し、基板側同士を貼り合わせてもよい。更に、複数の記録層が片面又は両面に形成された光記録媒体に対しても本発明は適用可能である。

【００８８】

又、前記第１～第３実施形態において光透過層１４、４４の形成工程で展延した樹脂に紫外線を照射して完全に硬化させた後に光透過層１４、４４に切り込み１６、４６を形成しているが、本発明はこれに限定されるものではなく、光透過層１４、４４の形成工程で紫外線の照射時間等を適宜制御することにより、展延した樹脂を半硬化状態とし、切り込み１６、４６を形成した後に紫外線を再照射して展延した樹脂を完全に硬化させるようにしてもよい。

【００８９】

光透過層１４、４４に刃を当接させて切り込み１６、４６を形成する場合、光透過層１４、４４は刃の厚さ方向に若干押し広げられることとなるが光透過層１４、４４が半硬化状態であれば刃の厚さ方向に容易に追従、変形することができ基板１２、４２からの剥離を確実に防止することができる。

【００９０】

展延した樹脂の半硬化の度合は、樹脂が刃に粘着することがない程度の硬さであり、且つ、刃の切り込みに追従して刃の厚さ方向に樹脂が容易に追従、変形して基板との境界面から剥離することがない程度の軟らかさであることが好ましい。

【００９１】

尚、光透過層における切り込みの内側部分を確実に打ち抜いて取り除くためには打ち抜き工程前に光透過層を完全に硬化させておくことが好ましい。

【００９２】

又、前記第１～第３実施形態において、光透過層は紫外線硬化性の樹脂であるが電子線硬化性の樹脂等、他の種類の放射線で硬化する性質の樹脂を使用してもよい。

【００９３】

又、前記第１～第３実施形態において、スピンコート法により基板に光透過層を形成しているが、本発明はこれに限定されるものではなく、例えば、光透過性のシート状材料を基板に貼り付けることにより、基板に光透過層を形成してもよい。更に、ドクターブレード法等の他の方法で基板に光透過層を形成してもよい。

【００９４】

又、前記第１～第３実施形態において、光透過層に工具を当接させ、基板と共に光透過層を回転させることにより切り込みを形成しているが、本発明はこれに限定されるものではなく、基板及び光透過層を固定し、工具を円軌道で移動させることにより、光透過層に切

り込みを形成してもよい。又、工具に代えて、レーザー光線を使用して切り込みを形成してもよい。又、例えば図１６に示されるように円筒状工具６０の端部を光透過層に圧接させて、切り込み１６（４６）を形成してもよい。

【００９５】

又、前記第１～第３実施形態において、打ち抜き工程において、光記録媒体を打ち抜き工具で光透過層側から基板側に打ち抜いて中心孔を形成しているが、本発明はこれに限定されるものではなく、切り込みの深さが充分な場合等、打ち抜きにより光透過層に作用するところの情報記録面から剥離する方向の力が小さい場合には図１７に示されるように基板１２（４２）側から光透過層１４（４４）側に光記録媒体を打ち抜き工具で打ち抜いて中心孔を形成してもよい。一方、切り込みが浅い場合等、打ち抜きにより光透過層に作用する、情報記録面から剥離する方向の力が大きい場合には、前記第１～第３実施形態のように、光透過層側から基板側に光記録媒体を打ち抜き工具で打ち抜いて中心孔を形成することが好ましい。

【００９６】

又、前記第１～第３実施形態において、基板１２、４２は成形工程で円形の凹部１２Ｂ、４２Ｂが成形されているが、本発明はこれに限定されるものではなく、基板１２、４２の打ち抜きが容易である場合には、円形の凹部がない円板形状に基板を成形し、打ち抜くようにしてもよい。

【００９７】

又、前記第３実施形態において、環状突起４８の突出量は光透過層４４の厚さと等しい０．１ｍｍであるが、本発明はこれに限定されるものではなく、環状突起４４の突出量を光透過層４４の厚さよりも大きくしても良い。このようにすることで、光記録媒体４０を複数重ねたり、光記録媒体４０を台上等に載置する場合に、光透過層４４が他の光記録媒体、台等に接触することを防止することができ、光透過層４４を保護することができる。尚、光記録媒体４０が若干傾斜すると、光透過層４４が他の光記録媒体等に接触し得るが、この場合も、当接圧を軽減することができ、光透過層４４を保護する一定の効果を期待することができる。

【００９８】

尚、環状突起４４の突出量が光透過層４４の厚さよりも小さい場合も、環状突起４４が光透過層４４の内周部を指、位置決め部品等から保護する一定の効果が得られる。

【００９９】

【発明の効果】

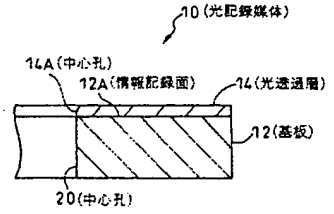
以上説明したように、本発明によれば、光透過層の内周部にバリ、剥離を発生させることなく、中心孔を形成し、均一な厚さで光透過層を基板に形成することが可能となるという優れた効果がもたらされる。

【図面の簡単な説明】

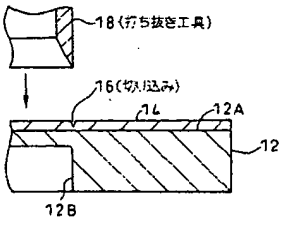
【図１】本発明の第１実施形態に係る光記録媒体の構造を示す断面図
【図２】同光記録媒体の打ち抜き工程を示す断面図
【図３】同光記録媒体の基板の成形工程を示す断面図
【図４】同光記録媒体の光記録層の形成工程における樹脂の展延を示す断面図
【図５】同形成工程により形成された光記録層を示す断面図
【図６】同光記録媒体の切り込み工程を示す断面図
【図７】同斜視図
【図８】本発明の第２実施形態に係る光記録媒体の構造を示す断面図
【図９】同光記録媒体の打ち抜き工程を示す断面図
【図１０】同光記録媒体の切り込み工程を示す断面図
【図１１】本発明の第３実施形態に係る光記録媒体の構造を示す断面図
【図１２】同光記録媒体の打ち抜き工程を示す断面図
【図１３】同光記録媒体の基板の成形工程を示す断面図
【図１４】同光記録媒体の光記録層の形成工程を示す断面図

【図１５】同光記録媒体の切り込み工程を示す断面図
【図１６】本発明の他の実施形態に係る切り込み工程を示す断面図
【図１７】本発明の他の実施形態に係る打ち抜き工程を示す断面図
【図１８】従来の光記録媒体の構造を示す斜視図
【図１９】同光記録媒体の打ち抜き工程を示す断面図
【図２０】同打ち抜き工程による光透過層の内周部のバリを示す断面図
【符号の説明】
１０、３０、４０、１００…光記録媒体
１２、４２、１０２…基板
１２Ａ、４２Ａ、１０２Ａ…情報記録面
１４、４４、１０４…光透過層
１６、４６…切り込み
１８…打ち抜き工具
１４Ａ、２０、４４Ａ、５０…中心孔
４３…円形突起
４８…環状突起

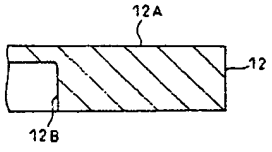
【図１】



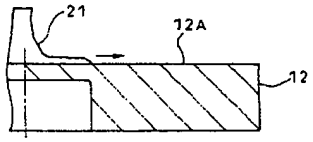
【図２】



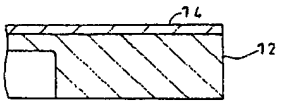
【図３】



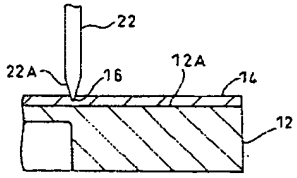
【図４】



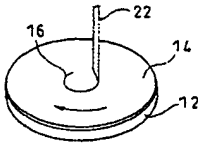
【図５】



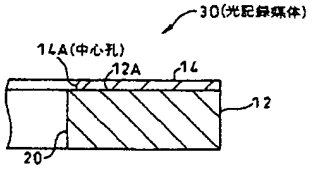
【図６】



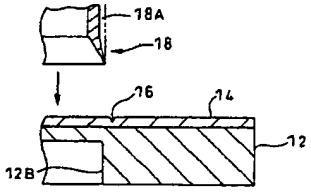
【図７】



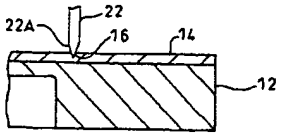
【図８】



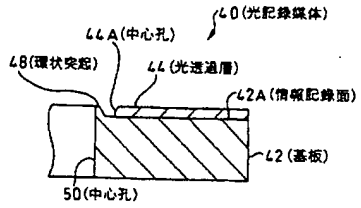
【図９】



【図１０】



【図１１】



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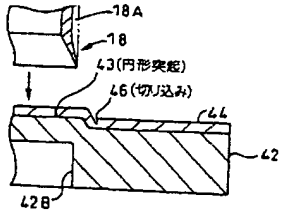

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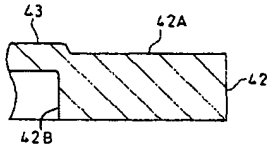

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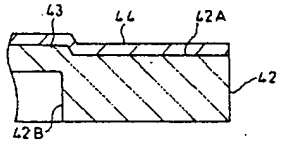

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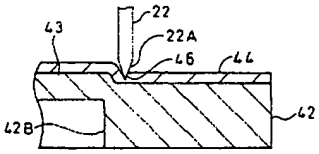

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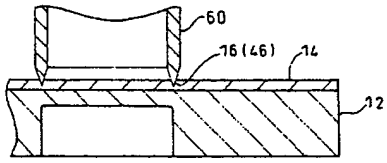

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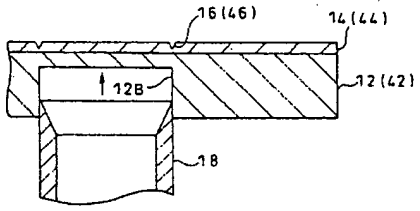

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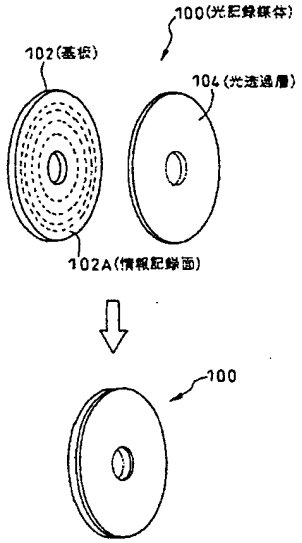
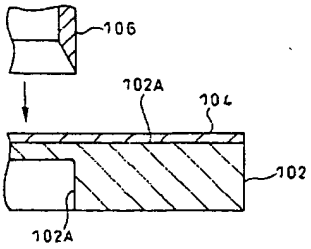
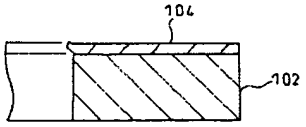

100(光記録媒体)
102(基板)
104(光透過層)
102A(情報記録面)
100

【図１９】


106
102A
104
102
102A

【図２０】


104
102

フロントページの続き

(72)発明者　山家　研二
東京都中央区日本橋一丁目１３番１号　ティーディーケイ株式会社内

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5D121 AA02　AA04　DD05　EE22　EE28　GG24　GG28

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]
It comes to contain the light transmission layer in which at least one side was formed in the substrate made into the information recording surface, and said information recording surface by the shape of a disk type in which the feed hole was formed more thinly than said substrate, and the feed hole where a bore is bigger than the feed hole of said substrate was formed.
The optical recording medium characterized by things.
[Claim 2]
In claim 1,
While the annular projection which projects in the thickness direction was formed in the surroundings of the feed hole of said substrate, the feed hole where a bore is bigger than the outer diameter of this annular projection was formed in said light transmission layer.
The optical recording medium characterized by things.
[Claim 3]
In claim 2,
The amount of projection of said annular projection is almost equal to the thickness of said light transmission layer.
The optical recording medium characterized by things.
[Claim 4]
It comes to contain the forming cycle which fabricates the substrate of the shape of a disk type at least whose one side is an information recording surface, the light transmission layer formation process which forms a light transmission layer thinner than said substrate in said information recording surface, the slitting process which forms circular slitting in this light transmission layer, and the punching process which pierces some [at least] fields inside this slitting, pierces by the tool, and forms a feed hole in said light transmission layer and said substrate.
The manufacture approach of the optical recording medium characterized by things.
[Claim 5]
In claim 4,
Slitting of said light transmission layer is formed for a bigger diameter than the bore of the feed hole of said substrate, and the feed hole where a bore is bigger than the feed hole of said substrate is formed in said light transmission layer by piercing said light transmission layer and said substrate, pressurizing the field inside this slitting in the thickness direction by said punching tool, and dividing said light transmission layer in said slitting.
The manufacture approach of the optical recording medium characterized by things.
[Claim 6]
In claim 5,
While fabricating the circular projection of a bigger outer diameter than the bore of the feed hole of said substrate by said forming cycle to said information recording surface, forming said slitting in said light

transmission layer along the outside of the periphery of said circular projection and forming an annular projection in the surroundings of the feed hole of said substrate by leaving the periphery section of said circular projection by said punching tool, and piercing said substrate, the feed hole where a bore is bigger than the outer diameter of this annular projection is formed in said light transmission layer.
The manufacture approach of the optical recording medium characterized by things.
[Claim 7]
In either of claims 4-6,
Said light transmission layer is formed by rotating this substrate, while supplying the resin which has a fluidity near the core of said substrate with said light transmission layer formation process, making said resin flow on the direction outside of a path with a centrifugal force, and spreading.
The manufacture approach of the optical recording medium characterized by things.
[Claim 8]
In claim 7,
A radiation is irradiated so that said light transmission layer may be in a semi-hardening condition with said light transmission layer formation process by using construction material of said light transmission layer as radiation-curing nature resin,
The re-exposure process which re-irradiates a radiation after said slitting process at the light transmission layer of said semi-hardening condition, and is stiffened thoroughly was established.
The manufacture approach of the optical recording medium characterized by things.
[Claim 9]
It comes to contain a slitting means to form slitting circular in said light transmission layer of the semifinished product of the optical recording medium which comes to form a light transmission layer thinner than this substrate in said information recording surface in the substrate of the shape of a disk type at least whose one side is an information recording surface, and a punching means to pierce some [at least] fields inside said slitting, to pierce by the tool, and to form a feed hole in said light transmission layer and said substrate.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the manufacture approach of an optical recording medium and an optical recording medium that the light transmission layer thinner than a substrate was formed in the information recording surface of a substrate, and the feed hole was formed, and a manufacturing installation.
[0002]
[Description of the Prior Art]
In recent years, optical recording media, such as CD (Compact Disc) and DVD (Digital Versatile Disc), have spread quickly as an information record medium. While DVD uses laser light with wavelength shorter than CD as an exposure light, it enables it to record and reproduce information mass by high density rather than CD by making numerical aperture of the lens of exposure light larger than CD, although an outer diameter is unified into 120mm and, as for the optical recording medium, thickness is generally unified into 1.2mm.
[0003]
On the other hand, since there is an inclination for comatic aberration to occur with the inclination (curvature) of a disk, and for informational record and exactness of reproduction to fall so that the wavelength of exposure light is short and the numerical aperture of a lens is large, DVD is setting thickness of a light transmission layer to 0.6mm of the one half of CD, secures the margin to the inclination (curvature) of a disk, and is maintaining informational record and exactness of reproduction.
[0004]
In addition, only in the 0.6mm light transmission layer, since rigidity and reinforcement are inadequate, it considers as the structure which DVD makes a 0.6mm substrate two sheets, makes an information recording surface inside, and was stuck, thickness is set to 1 or 2mm equal to CD, and rigidity equivalent to CD and reinforcement are secured.
[0005]
Moreover, generally a feed hole (for example, CD and DVD phi 15mm) is formed in an optical recording medium, and it is used for it for positioning in record, a regenerative apparatus, etc. Generally a feed hole is simultaneously fabricated by the forming cycle which fabricates a substrate in the shape of a disk type.
[0006]
Here, that record of still higher-density mass information should be realized, while making wavelength of exposure light brief further, there is a request of wanting to enlarge numerical aperture of a lens. The optical recording medium which made the light transmission layer much more thin is called for from this this request, and development of the optical recording medium which forms a light transmission layer thinner than a substrate in the information recording surface of the substrate as structure material, and sets total thickness to 1.2mm is furthered. In addition, the proposal which sets numerical aperture to 0.85

while using the laser light of the purple-blue color whose wavelength is 405nm as an exposure light that a specification should be unified, and sets thickness of a light transmission layer to 0.1mm corresponding to this is made.

[0007]

Drawing 18 is the perspective view showing the structure of an optical recording medium where such a thin light transmission layer was formed.

[0008]

An optical recording medium 100 is the one side type which can record information only on one side with the structure where the light transmission layer 104 thinner than a substrate 102 was formed in information recording surface 102A of a substrate 102.

[0009]

A substrate 102 is fabricated by injection molding with which the diameter generally excelled [mm / 1.1] in 120mm and thickness at mass production nature. It is injected between the molds of a couple, and is cooled and kept warm by predetermined temperature, and, specifically, resin, such as a polycarbonate, is fabricated in the shape of a disk type.

[0010]

As for the light transmission layer 104, thickness is formed in information recording surface 102A of a substrate 102 by a spin coat method etc. by 0.1mm. Specifically the resin of the light transmission nature of ultraviolet-rays hardenability or electron ray hardenability is supplied near the core of information recording surface 102A, a substrate 102 is rotated, and it spreads all over information recording surface 102A by making the supplied resin energize and flow on the direction outside of a path with a centrifugal force. Ultraviolet rays, an electron ray, etc. are irradiated after spreading, resin is stiffened, and a light transmission layer formation process is completed. In addition, in the double-sided type which can record information on both sides of a substrate, thickness of a substrate is set to 1.0mm, and it should just carry out the laminating of the 0.1mm light transmission layer to each of both sides of a substrate. Or thickness prepares two things which carried out the laminating of the light transmission layer which is 0.1mm, and may stick substrate sides on the substrate whose thickness is 0.5mm.

[0011]

[Problem(s) to be Solved by the Invention]

However, when a spin coat method is applied to the substrate with which the feed hole was formed, the thickness of the spread resin tends to become uneven and record of high-density information and playback may become difficult.

[0012]

Although the reason thickness becomes an ununiformity is not necessarily clear, it thinks in general as follows. It is spread to the whole substrate outside a supply location, a centrifugal force acting on resin promptly by revolution of a substrate, and flowing on the outside of the direction of a path rather than the supplied location, if resin is supplied to the perimeter of a feed hole. In order that a centrifugal force may always continue acting in the meantime, the thickness of the inside and an outside does not become homogeneity, but the inside is thin and serves as thickness distribution that an outside is thick. Moreover, although supplying resin additionally in order to compensate with thickness becoming thin is also considered, control of the high degree of accuracy according to dispersion in thickness is needed, and a actual top is difficult for such control.

[0013]

On the other hand, if it is a substrate without a feed hole, it can prevent that a centrifugal force acts on the resin which could supply resin inside the direction of a path rather than the case where the core of a substrate or a feed hole is, and supplied promptly. In this case, since the core of a substrate plays a role like a resin rich area ball and carries out additional supply of the resin continuously on an information recording surface, it is possible to spread resin by uniform thickness. In this case, since the spread resin is stiffened, as shown in drawing 19 , the light transmission layer 104 and a substrate 102 will be pierced, it will pierce by the tool 106, and a feed hole will be formed. In addition, sign 102A in drawing is the circular crevice fabricated to the field of information recording surface 102A of a substrate 102,

and an opposite hand, in order to make punching easy.
[0014]
However, since [whose thickness is about 0.1mm] it is a film very much, in case the light transmission layer 104 is pierced by the punching tool 106, it has the problem that weld flash may occur in the inner circumference section, or the inner circumference section may exfoliate from information recording surface 102A as shown in drawing 20 . Moreover, even if weld flash and exfoliation do not occur in a manufacture phase, when a finger etc. is inserted in a feed hole at the time of an activity, a finger etc. may touch the inner circumference section of a light transmission layer, and a light transmission layer may exfoliate.
[0015]
This invention makes it the technical problem to have been made in view of the above trouble, and to have been formed in the substrate by thickness with a uniform light transmission layer, and to provide the inner circumference section of a light transmission layer with the manufacture approach of weld flash, the optical recording medium which exfoliation cannot generate easily, and an optical recording medium, and a manufacturing installation.
[0016]
[Means for Solving the Problem]
In order to solve the above-mentioned technical problem, it found out that the light transmission layer which has a feed hole by forming circular slitting in a light transmission layer, piercing some [at least] fields inside this slitting, piercing by the tool, and forming a feed hole in a light transmission layer and a circular substrate could be certainly formed in a substrate by uniform thickness as a result of this invention person's inquiring wholeheartedly.
[0017]
That is, the above-mentioned technical problem is solvable with the following invention.
[0018]
(1) The optical recording medium characterized by coming to contain the light transmission layer in which at least one side was formed in the substrate made into the information recording surface, and said information recording surface by the shape of a disk type in which the feed hole was formed more thinly than said substrate, and the feed hole where a bore is bigger than the feed hole of said substrate was formed.
[0019]
(2) The optical recording medium of (1) characterized by forming in said light transmission layer the feed hole where a bore is bigger than the outer diameter of this annular projection while the annular projection which projects in the thickness direction was formed in the surroundings of the feed hole of said substrate.
[0020]
(3) (Two) optical recording media with which the amount of projection of said annular projection is characterized by being almost equal to the thickness of said light transmission layer.
[0021]
(4) The forming cycle which fabricates the substrate of the shape of a disk type at least whose one side is an information recording surface, The light transmission layer formation process which forms a light transmission layer thinner than said substrate in said information recording surface, The manufacture approach of the optical recording medium characterized by coming to contain the slitting process which forms circular slitting in this light transmission layer, and the punching process which pierces some [at least] fields inside this slitting, pierces by the tool, and forms a feed hole in said light transmission layer and said substrate.
[0022]
(5) The manufacture approach of the optical recording medium of (4) characterized by forming slitting of said light transmission layer for a bigger diameter than the bore of the feed hole of said substrate, and forming in said light transmission layer the feed hole where a bore is bigger than the feed hole of said substrate by piercing said light transmission layer and said substrate, pressurizing the field inside this

slitting in the thickness direction by said punching tool, and dividing said light transmission layer in said slitting.

[0023]

(6) Fabricate the circular projection of a bigger outer diameter than the bore of the feed hole of said substrate by said forming cycle to said information recording surface. Said slitting is formed in said light transmission layer along the outside of the periphery of said circular projection. The manufacture approach of the optical recording medium of (5) characterized by forming in said light transmission layer the feed hole where a bore is bigger than the outer diameter of this annular projection while forming an annular projection in the surroundings of the feed hole of said substrate by leaving the periphery section of said circular projection by said punching tool, and piercing said substrate.

[0024]

(7) The manufacture approach of one optical recording medium of (4) - (6) characterized by forming said light transmission layer by rotating this substrate while supplying the resin which has a fluidity near the core of said substrate with said light transmission layer formation process, making said resin flow on the direction outside of a path with a centrifugal force, and spreading.

[0025]

(8) The manufacture approach of the optical recording medium of (7) characterized by establishing the re-exposure process which irradiates a radiation so that said light transmission layer may be in a semi-hardening condition with said light transmission layer formation process by using construction material of said light transmission layer as radiation-curing nature resin, re-irradiates a radiation after said slitting process at the light transmission layer of said semi-hardening condition, and is stiffened thoroughly.

[0026]

(9) A shaping means to fabricate the substrate of the shape of a disk type at least whose one side is an information recording surface, The light transmission layer means forming which forms a light transmission layer thinner than this substrate in said information recording surface, The manufacturing installation of the optical recording medium characterized by coming to contain a slitting means to form circular slitting in this light transmission layer, and a punching means to pierce some [at least] fields inside said slitting, to pierce by the tool, and to form a feed hole in said light transmission layer and said substrate.

[0027]

(10) The optical recording medium of (2) characterized by the amount of projection of said annular projection being larger than the thickness of said light transmission layer.

[0028]

In addition, the bore of the feed hole of a light transmission layer and the outer diameter of the punching tool which pierces a light transmission layer are not necessarily in agreement. For example, when forming slitting of a bigger diameter than the bore of the feed hole of a substrate like the above (5), the punching tool of an outer diameter equal to the inside of the feed hole which it is going to form in a substrate is used. A light transmission layer is pressurized by the punching tool, is pierced, and is divided by slitting of the direction outside of a path rather than the periphery of a tool. Rather than slitting, rather than a punching tool, the direction inside part of a path is pierced also including the part of the direction outside of a path, is further extruded in the thickness direction by the tool, and is removed from an optical recording medium. That is, the feed hole of a light transmission layer is formed with a bigger bore than the outer diameter of a punching tool. On the other hand, if slitting is formed for a diameter equal to the bore of the feed hole of a substrate, it will pierce with the bore of the feed hole of a light transmission layer, and the outer diameter of a tool will be in agreement.

[0029]

Moreover, although the vocabulary a "radiation" means electromagnetic waves, such as the gamma ray and X-ray which are generally emit with breaking of a radioactive element, and alpha rays, and a corpuscular ray, suppose that the vocabulary a "radiation" is use in a meaning call the generic name of the electromagnetic wave which has the property to stiffen the specific resin of a floating condition and corpuscular rays, such as ultraviolet rays and an electron ray, in this description.

[0030]
[Embodiment of the Invention]
Hereafter, the operation gestalt of this invention is explained to a detail with reference to a drawing.
[0031]
Drawing 1 is the sectional view of the optical recording medium 10 concerning this operation gestalt. Drawing 2 is the sectional view showing the punching process at the time of manufacture of an optical recording medium 10.
[0032]
The forming cycle by which the manufacture approach of an optical recording medium 10 fabricates the substrate 12 of the shape of a disk type whose one side is information recording surface 12A, The light transmission layer formation process which forms the light transmission layer 14 thinner than a substrate 12 in information recording surface 12A, It is characterized by coming to contain the slitting process which forms the circular slitting 16 in the light transmission layer 14, and the punching process which pierces the field inside slitting 16, pierces by the tool 18, and forms feed-hole 14A and a feed hole 20 in the light transmission layer 14 and a substrate 12.
[0033]
About other processes, since it is the same as that of the manufacture approach of the conventional optical recording medium, explanation is omitted suitably.
[0034]
First, the forming cycle of a substrate 12 is explained.
[0035]
Resin, such as a polycarbonate which heated beforehand and was fused between the molds (graphic display abbreviation) of a couple, is injected, and it fabricates in the shape of [it is cooled and kept warm, and a diameter does not have 120mm in information recording surface 12A, and a feed hole does not have / in the shape of / thickness in a predetermined molding temperature at 1.1mm] a disk type. Under the present circumstances, detailed predetermined irregularity etc. is formed in information recording surface 12A by La Stampa (graphic display abbreviation) (refer to drawing 3). (graphic display abbreviation) It may replace with a polycarbonate and resin, such as an acrylic and epoxy, may be used. In addition, sign 12B in drawing is the circular crevice fabricated to the field of information recording surface 12A and an opposite hand, in order to make a substrate 12 easy to pierce at the punching process mentioned later, and the bore is fabricated equally to the bore of a feed hole (it forms behind) 20. Thus, a substrate 12 is fabricated, and it removes from a mold, and cools in ordinary temperature, and the stratum functionale is formed in information recording surface 12A at degree process.
[0036]
Here, the formation process of the stratum functionale is explained briefly. In addition, since the stratum functionale is not considered to be the need rather than the light transmission layer 14 especially for grasp of this invention while it is a film further, the graphic display of the stratum functionale is omitted. When an optical recording medium 10 is a type only for playbacks, a reflecting layer is formed in information recording surface 12A as stratum functionale. On the other hand, when optical recording media 10 are record and a refreshable type about information, a reflecting layer and a record layer are formed in information recording surface 12A in this order as stratum functionale. A reflecting layer consists of aluminum, Ag, Au, etc., and is formed with the sputtering method, vacuum deposition, etc. A record layer consists of a phase change ingredient, a coloring matter ingredient, an optical magnetic adjuster, etc., and is formed with the sputtering method, a spin coat method, the ripping method, vacuum deposition, etc.
[0037]
Next, a light transmission layer formation process is explained.
[0038]
The light transmission layer 14 is formed on the stratum functionale with a spin coat method.
[0039]

First, a substrate 12 is arranged horizontally, revolution actuation is carried out, and as shown in drawing 4 , specified quantity supply of the resin 21 of ultraviolet-rays hardenability is carried out from the upper part in the core of a substrate 12. The centrifugal force which is proportional to distance from the core of a substrate 12 acts on resin 21, and thereby, resin 21 is energized by the direction outside of a path, and is spread by the whole information recording surface 12A. Under the present circumstances, in order that a centrifugal force may hardly act on the resin 21 near the core, the core of a substrate 12 plays a role like ********, and carries out additional supply of the resin 21 continuously on information recording surface 12A. Thereby, as shown in the whole information recording surface 12A at drawing 5 , resin 21 is spread by uniform thickness. A light transmission layer formation process is completed by irradiating resin 21 and making it harden ultraviolet rays after spreading.

[0040]

Next, a slitting process is explained.

[0041]

First, cutting part 22A of a tool 22 is made to contact the position of the light transmission layer 14, as shown in drawing 6 . Cutting part 22A is made to specifically contact the location corresponding to the inner circumference of the feed hole 20 formed behind. If the light transmission layer 14 is rotated with a substrate 12 in this condition as shown in drawing 7 , the circular slitting 16 will be formed in the light transmission layer 14 in the shape of a said alignment. The depth of slitting 16 may be made shallower than the thickness of the light transmission layer 14, and may be made equal to the thickness of the light transmission layer 14. Moreover, it is made deeper than the thickness of the light transmission layer 14, and you may make it even a substrate 12 cut deeply.

[0042]

Next, a punching process is explained.

[0043]

First, the circular punching tool 18 of an outer diameter equal to the bore of the feed hole 20 which it is going to form is prepared, as shown in drawing 2 , it pierces, it pierces so that the periphery of a tool 18 may cut deeply and it may be in agreement with 16, and a tool 18 is made to counter the light transmission layer 14 in the shape of a said alignment. Next, the punching tool 18 is energized in the direction of this light transmission layer 14, and as the light transmission layer 14 and a substrate 12 are pierced, it pierces by the tool 18 and it is shown in drawing 1 , while forming feed-hole 14A in the light transmission layer 14, a feed hole 20 is formed in a substrate 12. In addition, feed-hole 14A and a feed hole 20 have an equal bore.

[0044]

Under the present circumstances, since it pierces in a light transmission layer, cut in it deeply in advance of a process, and slitting by the process is formed in it, and stress concentrates on the part of the slitting 16 of the light transmission layer 14, the light transmission layer 14 is cut deeply and it is divided into accuracy in the part of 16, weld flash does not occur in the inner circumference section of the light transmission layer 14, or the inner circumference section does not exfoliate from information recording surface 12A.

[0045]

An optical recording medium 10 is completed by the above. Since an optical recording medium 10 has the uniform thickness of the light transmission layer 14, while being able to record high-density information on accuracy and being able to reproduce, the inner circumference section sticks to information recording surface 12A certainly, and cannot exfoliate easily, and it is reliable.

[0046]

In addition, although feed-hole 14A of the feed hole 20 of a substrate 12 and the light transmission layer 14 is circular and it is formed in the optical recording medium 10 in the shape of a said alignment, naturally the eccentricity of the some from this circular and strict cardiac condition from which it separated a little from the strict perfect circle configuration is permitted that the precision of the perfect circle of feed holes 20 and 14A and the precision of this alignment should just be in the dimensional tolerance required of an optical recording medium.

[0047]
Next, the 2nd operation gestalt of this invention is explained.
[0048]
Drawing 8 is the sectional view showing the structure of the optical recording medium 30 concerning a **** 2 operation gestalt.
[0049]
The optical recording medium 30 is characterized by forming feed-hole 14A with a bigger bore than the feed hole 20 of a substrate 12 in the light transmission layer 14.
[0050]
Moreover, the manufacture approach of an optical recording medium 30 forms the slitting 16 of the light transmission layer 14 for a bigger diameter than the bore of the feed hole 20 of a substrate 12, as shown in drawing 9 . Pierce the field inside slitting 16, pressurize in the thickness direction by the tool 18, cut the light transmission layer 14 deeply, and it sets to 16. It is characterized by forming feed-hole 14A with a bigger bore than the feed hole 20 of a substrate 12 in the light transmission layer 14 by piercing the light transmission layer 14 and a substrate 12, dividing.
[0051]
About other points, since it is the same as that of the manufacture approach of said optical recording medium 10 and an optical recording medium 10, explanation is omitted suitably.
[0052]
First, a slitting process is explained.
[0053]
As shown in drawing 10 , rather than the location corresponding to the inner circumference of the feed hole 20 behind formed in a substrate 12, cutting part 22A of a tool 22 is made to contact the light transmission layer 14 a little in the location of the outside of the direction of a path, and the light transmission layer 14 is rotated with a substrate 12 in this condition. Thereby, the circular slitting 16 is formed in the light transmission layer 14 in the shape of a said alignment for a bigger diameter a little than the bore of the feed hole 20 behind formed in a substrate 12.
[0054]
Next, a punching process is explained.
[0055]
It pierces so that it may be in agreement with the inner circumference of the feed hole 20 which the periphery of the punching tool 18 tends to form in a substrate 12 first, and a tool 18 is made to counter the light transmission layer 14, as shown in drawing 9 . Next, the punching tool 18 is energized in the direction of the light transmission layer 14, and the feed hole 20 as pierced the light transmission layer 14 and a substrate 12, pierced by the tool 18 and shown in drawing 8 is formed in a substrate 12.
[0056]
Under the present circumstances, the punching tool 18 pressurizes the field inside the slitting 16 in the light transmission layer 14 at a substrate 12 side, cuts the light transmission layer 14 deeply, divides it in 16, and to a substrate 12 side, as it extrudes the inside part of slitting 16, it pierces it.
[0057]
In addition, although the diameter of the slitting 16 in the light transmission layer 14 is larger than the bore of the feed hole 20 of a substrate 12, it cuts deeply, and the inside part of 16 being extruded in the thickness direction by the punching tool 18, and forming the feed hole 20 of a substrate 12, this feed hole 20 is inserted in and it is removed. Moreover, crevice (roll off) 18A to which it can pierce to the cutting part peripheral face of a punching tool inside slitting, and the light transmission layer outside a tool (the shape of a ring) can enter into it is prepared, and you may enable it to remove the light transmission layer of the part concerned efficiently.
[0058]
Thereby, feed-hole 14A with a larger bore than the feed hole 20 of a substrate 12 is formed in the light transmission layer 14.
[0059]

In addition, since it pierces in a light transmission layer, cut in it deeply in advance of a process, and slitting by the process is formed in it also in this case, and stress concentrates on the part of the slitting 16 of the light transmission layer 14, the light transmission layer 14 is cut deeply and it is divided into accuracy in the part of 16, weld flash does not occur in the inner circumference section of the light transmission layer 14, or the inner circumference section does not exfoliate from information recording surface 12A.

[0060]

Thus, by making feed-hole 14A of the light transmission layer 14 larger than the feed hole 20 of a substrate 12, even if it inserts a finger in a feed hole 20, it is hard coming to touch the inner circumference section of the light transmission layer 14 directly a finger, and exfoliation of the light transmission layer 14 by human handling can also be prevented.

[0061]

Similarly, when loading an information recording device, an information regenerative apparatus, etc. with an optical recording medium 30, exfoliation of the light transmission layer 14 at the time of the components for positioning etc. not contacting the inner circumference section of the light transmission layer 14, and using it with these equipments can also be prevented.

[0062]

Moreover, although there is a difference in the bore of the feed hole 20 of a substrate 12, and the bore of feed-hole 14A of the light transmission layer 14, two feed holes 20 and 14A can be formed by 1 time of punching by the punching tool 18 by forming slitting 16, and productive efficiency is good.

[0063]

In addition, naturally the eccentricity of the some from this circular and strict cardiac condition from which it separated a little from the strict perfect circle is permitted like said 1st operation gestalt that the precision of the perfect circle of the feed hole 20 of a substrate 12 and the precision of this alignment over an optical recording medium 30 should just be in the dimensional tolerance required of an optical recording medium 30.

[0064]

Moreover, that feed-hole 14A of the light transmission layer 14 should just be formed so that inner circumference may be located in the direction outside of a path rather than the feed hole 20 of a substrate 12, the precision of a perfect circle required of feed-hole 14A of the light transmission layer 14 and the precision of this alignment over an optical recording medium 30 need to be lower than the precision required of the feed hole 20 of a substrate 12, and do not necessarily need to be the feed hole 20 and this alignment of a substrate 12. That is, the precision required of formation of slitting 16 is low, and a slitting activity is so easy. Moreover, it is necessary to pierce in the case of punching and to cut deeply with a tool 18 that the punching tool 18 is deeply cut so that it may be in agreement with the feed hole 20 which it is going to form in a substrate 12, and it should just pierce the field inside 16, and 16 does not necessarily need to be in this cardiac condition.

[0065]

Next, the 3rd operation gestalt of this invention is explained.

[0066]

Drawing 11 is the sectional view showing the structure of the optical recording medium 40 concerning a **** 3 operation gestalt.

[0067]

The optical recording medium 40 is characterized by forming feed-hole 44A with a bigger bore than the outer diameter of the annular projection 48 in the light transmission layer 44 while the annular projection 48 which projects in the thickness direction is formed in the surroundings of the feed hole 50 of a substrate 42.

[0068]

As shown in drawing 12 , moreover, the manufacture approach of an optical recording medium 40 The circular projection 43 of a bigger outer diameter than the bore of the feed hole 50 of the substrate 42 behind formed by the forming cycle is fabricated to information recording surface 42A. Cut deeply in

the light transmission layer 44 along the outside of the periphery of the circular projection 43, and 46 is formed. While forming the annular projection 48 in a substrate 42 around a feed hole 50 and a feed hole 50 by leaving the periphery section of the circular projection 43 by the punching tool 18, and piercing a substrate 42, it is characterized by forming feed-hole 44A with a bigger bore than the outer diameter of this annular projection 48 in the light transmission layer 44.

[0069]

About other points, since it is the same as that of the manufacture approach of said optical recording media 10 and 30 and these optical recording media, explanation is omitted suitably.

[0070]

First, the forming cycle of a substrate 42 is explained.

[0071]

The circular projection 43 as shown in the information recording surface 42A side of a substrate 42 at drawing 13 is formed by establishing the circular crevice in the core of the mold which fabricates information recording surface 42A among the molds (graphic display abbreviation) of the couple which fabricates a substrate 42. The circular projection 43 is fabricated in the shape of a said alignment so that it may become a big outer diameter a little from the bore of the feed hole 50 formed behind. In addition, the thickness of parts other than circular projection 43 fabricates a substrate 42 so that 1.1mm and the amount of projection of the circular projection 43 may be set to 0.1mm. Moreover, the circular projection is prepared in the core of the mold which fabricates the field of information recording surface 42A of a substrate 42, and an opposite hand, and information recording surface 42A of a substrate 42 and crevice 42B circular to an opposite hand are fabricated in the shape of a said alignment. In addition, circular crevice 42B is fabricated so that a bore may become equal to the bore of the feed hole 50 formed behind.

[0072]

Next, the formation process of the light transmission layer 44 is explained.

[0073]

First, a substrate 42 is arranged horizontally, revolution actuation is carried out, and specified quantity supply of the ultraviolet-rays hardenability resin is carried out from the upper part in the core of this substrate 42. The centrifugal force which is proportional to distance from the core of a substrate 42 acts on the supplied resin, and it is energized by the direction outside of a path, and is spread by the whole information recording surface 42A. Under the present circumstances, in order that a centrifugal force may hardly act on the resin near the center of rotation, the core of a substrate 42 plays a role like ********, and carries out additional supply of the resin continuously on information recording surface 42A. Thereby, as shown in drawing 14 , resin is spread by the whole information recording surface 42A by uniform thickness. In addition, since resin is spread by uniform thickness also on the circular projection 43, the light transmission layer 44 is formed a ** with a stage. After spreading, irradiate resin, it is made to harden ultraviolet rays and the formation process of the light transmission layer 44 is completed.

[0074]

Next, a slitting process is explained.

[0075]

As shown in drawing 15 , slitting 46 is formed near the level difference part of the light transmission layer 44 so that the outside of the periphery of the circular projection 43 may be met. In addition, since it is the same as said 1st and 2nd operation gestalt about the tool which forms slitting 46, explanation is omitted.

[0076]

Next, a punching process is explained.

[0077]

First, it pierces so that it may be in agreement with the inner circumference of the feed hole 50 which the periphery of the punching tool 18 tends to form, and a tool 18 is made to counter the light transmission layer 44, as shown in drawing 12 . Next, the punching tool 18 is energized in the direction of the light

transmission layer 44, it leaves the periphery section and the circular projection 43 is pierced, while forming the feed hole 50 as shown in drawing 11 , it leaves a part of circular projection 43, and the annular projection 48 is formed in the surroundings of a feed hole 50.
[0078]
Under the present circumstances, the punching tool 18 pressurizes in the thickness direction, cuts the light transmission layer 44 on the circular projection 43 deeply, divides it in 46, and it is pierced so that the inside part of slitting 46 may be extruded to a substrate 42 side. Thereby, feed-hole 44A with a bigger bore than the outer diameter of the annular projection 48 is formed in the light transmission layer 44.
[0079]
Since it pierces in a light transmission layer, cut in it deeply in advance of a process, and slitting by the process is formed in it also in this case, and stress concentrates on the part of the slitting 46 of the light transmission layer 44, the light transmission layer 44 is cut deeply and it is divided into accuracy in the part of 46, weld flash does not occur in the inner circumference section of the light transmission layer 44, or the inner circumference section does not exfoliate from information recording surface 42A.
[0080]
That is, like said optical recording media 10 and 30, the thickness of the light transmission layer 44 is uniform, the inner circumference section of the light transmission layer 44 sticks to information recording surface 42A certainly, and cannot exfoliate easily, and an optical recording medium 40 is reliable while it can record and reproduce information at accuracy.
[0081]
Furthermore, since the annular projection 48 is formed inside the inner circumference section of the light transmission layer 44, even if it inserts a finger in a feed hole 50, a finger cannot touch the inner circumference section of the light transmission layer 44 directly, and exfoliation of the light transmission layer 44 by human handling can also be prevented certainly.
[0082]
Similarly, when loading an information recording device, an information regenerative apparatus, etc. with an optical recording medium 40, exfoliation of the light transmission layer 44 at the time of the components for positioning etc. not contacting the inner circumference section of the light transmission layer 44, and using it with these equipments etc. can also be prevented certainly.
[0083]
That is, since the inner circumference section of the light transmission layer 44 is protected by the annular projection 48, exfoliation of the light transmission layer 44 can be prevented certainly.
[0084]
Moreover, although there is a difference in the bore of the feed hole 50 of a substrate 42, and the bore of feed-hole 44A of the light transmission layer 44, two feed holes 50 and 44A and the annular projection 48 can be formed by 1 time of punching by the punching tool 18 by forming slitting 46, and productive efficiency is good.
[0085]
In addition, the annular projection 48 does not necessarily need to have [that what is necessary is just to project in the thickness direction around the feed hole 50 of a substrate 42] the fixed width of face of the direction of a path. That is, the periphery of the annular projection 48 does not need to be the round shape of an optical recording medium 40 and this alignment. Therefore, in the forming cycle of a substrate 42, eccentricity of the circular projection 43 may be carried out a little, and you may form.
[0086]
Moreover, feed-hole 44A of the light transmission layer 44 does not need to be the round shape of an optical recording medium 40 and this alignment that what is necessary is to just be formed so that inner circumference may be located in the direction outside of a path rather than the annular projection 48. Therefore, slitting which was cut deeply and carried out eccentricity to the light transmission layer 44 a little also at the process may be formed.
[0087]

Moreover, in said the 1st - 3rd operation gestalt, although the optical recording medium is considered as the one side type which can record information only on one side, this invention is not limited to this and, naturally this invention can be applied also to the optical recording medium of the double-sided type which can record information on both sides. In this case, thickness can consider as the optical recording medium which is 1.2mm by setting thickness of a substrate to 1.0mm and carrying out the laminating of the 0.1mm light transmission layer to both sides of a substrate. Or thickness prepares two things which carried out the laminating of the light transmission layer which is 0.1mm, and may stick substrate sides on the substrate whose thickness is 0.5mm. Furthermore, two or more record layers can apply this invention also to the optical recording medium formed in one side or both sides.

[0088]

Moreover, although it cuts deeply in the light transmission layers 14 and 44 and 16 and 46 are formed after irradiating ultraviolet rays to the resin spread with the formation process of the light transmission layers 14 and 44 in said the 1st - 3rd operation gestalt and making it harden thoroughly This invention makes the spread resin a semi-hardening condition, and after it forms slitting 16 and 46, you may make it stiffen thoroughly the resin which re-irradiated ultraviolet rays and spread them by not being limited to to this and controlling the irradiation time of ultraviolet rays etc. by the formation process of the light transmission layers 14 and 44 suitably.

[0089]

When making a cutting edge contact the light transmission layers 14 and 44, cutting deeply and forming 16 and 46, although it can extend a little in the thickness direction of a cutting edge, if the light transmission layers 14 and 44 are in a semi-hardening condition, easily, it can follow, and the light transmission layers 14 and 44 can deform in the thickness direction of a cutting edge, and can prevent the exfoliation from substrates 12 and 42 certainly.

[0090]

As for the degree of the semi-hardening of the spread resin, it is desirable that it is the hardness which is extent with which resin does not adhere to a cutting edge, and is the softness which is extent which slitting of a cutting edge is followed, and resin follows and deforms in the thickness direction of a cutting edge easily, and does not exfoliate from an interface with a substrate.

[0091]

In addition, in order to pierce certainly the inside part of slitting in a light transmission layer and to remove it, it is desirable to pierce and to stiffen a light transmission layer thoroughly before a process.

[0092]

Moreover, in said the 1st - 3rd operation gestalt, although a light transmission layer is resin of ultraviolet-rays hardenability, it may use the resin of the property hardened with the radiation of other classes, such as resin of electron ray hardenability.

[0093]

Moreover, in said the 1st - 3rd operation gestalt, although the light transmission layer is formed in a substrate with the spin coat method, this invention is not limited to this and may form a light transmission layer in a substrate by sticking the sheet-like ingredient of light transmission nature on a substrate for example. Furthermore, a light transmission layer may be formed in a substrate by other approaches, such as a doctor blade method.

[0094]

Moreover, in said the 1st - 3rd operation gestalt, slitting may be formed in a light transmission layer by making a tool contact a light transmission layer, not limiting this invention to this, fixing a substrate and a light transmission layer, and moving a tool in a circular orbit, although slitting is formed by rotating a light transmission layer with a substrate. Moreover, it may replace with a tool and slitting may be formed using a laser beam. Moreover, as shown, for example in drawing 16 , the pressure welding of the edge of the cylindrical tool 60 may be carried out to a light transmission layer, and slitting 16 (46) may be formed.

[0095]

Moreover, although an optical recording medium is pierced, it pierces from a light transmission layer

side to a substrate side by the tool in a punching process in said the 1st - 3rd operation gestalt and the feed hole is formed This invention is not what is limited to this. When the depth of slitting is enough etc., When the force of a direction of exfoliating from the information recording surface which acts on a light transmission layer by punching is small, as shown in drawing 17 , an optical recording medium may be pierced from a substrate 12 (42) side to the light transmission layer 14 (44) side, it may pierce by the tool, and a feed hole may be formed. When the force of a direction of on the other hand exfoliating from the information recording surface which acts on a light transmission layer by punching when slitting is shallow is large, it is desirable to pierce an optical recording medium from a light transmission layer side to a substrate side, to pierce by the tool like said the 1st - 3rd operation gestalt, and to form a feed hole.

[0096]

Moreover, although the circular crevices 12B and 42B are fabricated by the forming cycle, substrates 12 and 42 are not limited to this, and this invention fabricates a substrate in the shape of [without a circular crevice] a disk type, and you may make it pierce it in said the 1st - 3rd operation gestalt, when punching of substrates 12 and 42 is easy.

[0097]

Moreover, in said 3rd operation gestalt, although the amount of projection of the annular projection 48 is 0.1mm equal to the thickness of the light transmission layer 44, this invention is not limited to this and may make the amount of projection of the annular projection 44 larger than the thickness of the light transmission layer 44. By doing in this way, when it is [optical recording medium / 40] sufficient in two or more [-fold] and lays an optical recording medium 40 in base superiors, the light transmission layer 44 can prevent contacting other optical recording media, a base, etc., and can protect the light transmission layer 44. In addition, although the light transmission layer 44 can contact other optical recording media etc. if an optical recording medium 40 inclines a little, contact pressure can be mitigated also in this case and the fixed effectiveness of protecting the light transmission layer 44 can be expected.

[0098]

In addition, also when the amount of projection of the annular projection 44 is smaller than the thickness of the light transmission layer 44, the fixed effectiveness that the annular projection 44 protects the inner circumference section of the light transmission layer 44 from a finger, positioning components, etc. is acquired.

[0099]

[Effect of the Invention]

The outstanding effectiveness of becoming possible to form a feed hole and to form a light transmission layer in a substrate by uniform thickness is brought about without making the inner circumference section of a light transmission layer generate weld flash and exfoliation, as explained above according to this invention.

[Brief Description of the Drawings]

[Drawing 1] The sectional view showing the structure of the optical recording medium concerning the 1st operation gestalt of this invention

[Drawing 2] The sectional view showing the punching process of this optical recording medium

[Drawing 3] The sectional view showing the forming cycle of the substrate of this optical recording medium

[Drawing 4] The sectional view showing spreading of the resin in the formation process of the optical recording layer of this optical recording medium

[Drawing 5] The sectional view showing the optical recording layer formed of the homeoplasia process

[Drawing 6] The sectional view showing the slitting process of this optical recording medium

[Drawing 7] This perspective view

[Drawing 8] The sectional view showing the structure of the optical recording medium concerning the 2nd operation gestalt of this invention

[Drawing 9] The sectional view showing the punching process of this optical recording medium

[Drawing 10] The sectional view showing the slitting process of this optical recording medium
[Drawing 11] The sectional view showing the structure of the optical recording medium concerning the 3rd operation gestalt of this invention
[Drawing 12] The sectional view showing the punching process of this optical recording medium
[Drawing 13] The sectional view showing the forming cycle of the substrate of this optical recording medium
[Drawing 14] The sectional view showing the formation process of the optical recording layer of this optical recording medium
[Drawing 15] The sectional view showing the slitting process of this optical recording medium
[Drawing 16] The sectional view showing the slitting process concerning other operation gestalten of this invention
[Drawing 17] The sectional view showing the punching process concerning other operation gestalten of this invention
[Drawing 18] The perspective view showing the structure of the conventional optical recording medium
[Drawing 19] The sectional view showing the punching process of this optical recording medium
[Drawing 20] The sectional view showing the weld flash of the inner circumference section of the light transmission layer by this punching process
[Description of Notations]
10, 30, 40,100 -- Optical recording medium
12 42,102 -- Substrate
12A, 42A, 102A -- Information recording surface
14 44,104 -- Light transmission layer
16 46 -- Slitting
18 -- Punching tool
14A, 20, 44A, 50 -- Feed hole
43 -- Circular projection
48 -- Annular projection

[Translation done.]

* NOTICES *

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TECHNICAL FIELD

[Field of the Invention]
This invention relates to the manufacture approach of an optical recording medium and an optical recording medium that the light transmission layer thinner than a substrate was formed in the information recording surface of a substrate, and the feed hole was formed, and a manufacturing installation.
[0002]

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention]
The outstanding effectiveness of becoming possible to form a feed hole and to form a light transmission layer in a substrate by uniform thickness is brought about without making the inner circumference section of a light transmission layer generate weld flash and exfoliation, as explained above according to this invention.

[Translation done.]

PRIOR ART

[Description of the Prior Art]
In recent years, optical recording media, such as CD (Compact Disc) and DVD (Digital Versatile Disc), have spread quickly as an information record medium. While DVD uses laser light with wavelength shorter than CD as an exposure light, it enables it to record and reproduce information mass by high density rather than CD by making numerical aperture of the lens of exposure light larger than CD, although an outer diameter is unified into 120mm and, as for the optical recording medium, thickness is generally unified into 1.2mm.
[0003]
On the other hand, since there is an inclination for comatic aberration to occur with the inclination (curvature) of a disk, and for informational record and exactness of reproduction to fall so that the wavelength of exposure light is short and the numerical aperture of a lens is large, DVD is setting thickness of a light transmission layer to 0.6mm of the one half of CD, secures the margin to the inclination (curvature) of a disk, and is maintaining informational record and exactness of reproduction.
[0004]
In addition, only in the 0.6mm light transmission layer, since rigidity and reinforcement are inadequate, it considers as the structure which DVD makes a 0.6mm substrate two sheets, makes an information recording surface inside, and was stuck, thickness is set to 1 or 2mm equal to CD, and rigidity equivalent to CD and reinforcement are secured.
[0005]
Moreover, generally a feed hole (for example, CD and DVD phi 15mm) is formed in an optical recording medium, and it is used for it for positioning in record, a regenerative apparatus, etc. Generally a feed hole is simultaneously fabricated by the forming cycle which fabricates a substrate in the shape of a disk type.
[0006]
Here, that record of still higher-density mass information should be realized, while making wavelength of exposure light brief further, there is a request of wanting to enlarge numerical aperture of a lens. The optical recording medium which made the light transmission layer much more thin is called for from this this request, and development of the optical recording medium which forms a light transmission layer thinner than a substrate in the information recording surface of the substrate as structure material, and sets total thickness to 1.2mm is furthered. In addition, the proposal which sets numerical aperture to 0.85 while using the laser light of the purple-blue color whose wavelength is 405nm as an exposure light that a specification should be unified, and sets thickness of a light transmission layer to 0.1mm corresponding to this is made.
[0007]
Drawing 18 is the perspective view showing the structure of an optical recording medium where such a thin light transmission layer was formed.
[0008]
An optical recording medium 100 is the one side type which can record information only on one side

with the structure where the light transmission layer 104 thinner than a substrate 102 was formed in information recording surface 102A of a substrate 102.
[0009]
A substrate 102 is fabricated by injection molding with which the diameter generally excelled [mm / 1.1] in 120mm and thickness at mass production nature. It is injected between the molds of a couple, and is cooled and kept warm by predetermined temperature, and, specifically, resin, such as a polycarbonate, is fabricated in the shape of a disk type.
[0010]
As for the light transmission layer 104, thickness is formed in information recording surface 102A of a substrate 102 by a spin coat method etc. by 0.1mm. Specifically the resin of the light transmission nature of ultraviolet-rays hardenability or electron ray hardenability is supplied near the core of information recording surface 102A, a substrate 102 is rotated, and it spreads all over information recording surface 102A by making the supplied resin energize and flow on the direction outside of a path with a centrifugal force. Ultraviolet rays, an electron ray, etc. are irradiated after spreading, resin is stiffened, and a light transmission layer formation process is completed. In addition, in the double-sided type which can record information on both sides of a substrate, thickness of a substrate is set to 1.0mm, and it should just carry out the laminating of the 0.1mm light transmission layer to each of both sides of a substrate. Or thickness prepares two things which carried out the laminating of the light transmission layer which is 0.1mm, and may stick substrate sides on the substrate whose thickness is 0.5mm.
[0011]

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]
However, when a spin coat method is applied to the substrate with which the feed hole was formed, the thickness of the spread resin tends to become uneven and record of high-density information and playback may become difficult.
[0012]
Although the reason thickness becomes an ununiformity is not necessarily clear, it thinks in general as follows. It is spread to the whole substrate outside a supply location, a centrifugal force acting on resin promptly by revolution of a substrate, and flowing on the outside of the direction of a path rather than the supplied location, if resin is supplied to the perimeter of a feed hole. In order that a centrifugal force may always continue acting in the meantime, the thickness of the inside and an outside does not become homogeneity, but the inside is thin and serves as thickness distribution that an outside is thick. Moreover, although supplying resin additionally in order to compensate with thickness becoming thin is also considered, control of the high degree of accuracy according to dispersion in thickness is needed, and a actual top is difficult for such control.
[0013]
On the other hand, if it is a substrate without a feed hole, it can prevent that a centrifugal force acts on the resin which could supply resin inside the direction of a path rather than the case where the core of a substrate or a feed hole is, and supplied promptly. In this case, since the core of a substrate plays a role like a resin rich area ball and carries out additional supply of the resin continuously on an information recording surface, it is possible to spread resin by uniform thickness. In this case, since the spread resin is stiffened, as shown in drawing 19 , the light transmission layer 104 and a substrate 102 will be pierced, it will pierce by the tool 106, and a feed hole will be formed. In addition, sign 102A in drawing is the circular crevice fabricated to the field of information recording surface 102A of a substrate 102, and an opposite hand, in order to make punching easy.
[0014]
However, since [whose thickness is about 0.1mm] it is a film very much, in case the light transmission layer 104 is pierced by the punching tool 106, it has the problem that weld flash may occur in the inner circumference section, or the inner circumference section may exfoliate from information recording surface 102A as shown in drawing 20 . Moreover, even if weld flash and exfoliation do not occur in a manufacture phase, when a finger etc. is inserted in a feed hole at the time of an activity, a finger etc. may touch the inner circumference section of a light transmission layer, and a light transmission layer may exfoliate.
[0015]
This invention makes it the technical problem to have been made in view of the above trouble, and to have been formed in the substrate by thickness with a uniform light transmission layer, and to provide the inner circumference section of a light transmission layer with the manufacture approach of weld flash, the optical recording medium which exfoliation cannot generate easily, and an optical recording medium, and a manufacturing installation.

[0016]

[Translation done.]

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MEANS

[Means for Solving the Problem]
In order to solve the above-mentioned technical problem, it found out that the light transmission layer which has a feed hole by forming circular slitting in a light transmission layer, piercing some [at least] fields inside this slitting, piercing by the tool, and forming a feed hole in a light transmission layer and a circular substrate could be certainly formed in a substrate by uniform thickness as a result of this invention person's inquiring wholeheartedly.
[0017]
That is, the above-mentioned technical problem is solvable with the following invention.
[0018]
(1) The optical recording medium characterized by coming to contain the light transmission layer in which at least one side was formed in the substrate made into the information recording surface, and said information recording surface by the shape of a disk type in which the feed hole was formed more thinly than said substrate, and the feed hole where a bore is bigger than the feed hole of said substrate was formed.
[0019]
(2) The optical recording medium of (1) characterized by forming in said light transmission layer the feed hole where a bore is bigger than the outer diameter of this annular projection while the annular projection which projects in the thickness direction was formed in the surroundings of the feed hole of said substrate.
[0020]
(3) (Two) optical recording media with which the amount of projection of said annular projection is characterized by being almost equal to the thickness of said light transmission layer.
[0021]
(4) The forming cycle which fabricates the substrate of the shape of a disk type at least whose one side is an information recording surface, The light transmission layer formation process which forms a light transmission layer thinner than said substrate in said information recording surface, The manufacture approach of the optical recording medium characterized by coming to contain the slitting process which forms circular slitting in this light transmission layer, and the punching process which pierces some [at least] fields inside this slitting, pierces by the tool, and forms a feed hole in said light transmission layer and said substrate.
[0022]
(5) The manufacture approach of the optical recording medium of (4) characterized by forming slitting of said light transmission layer for a bigger diameter than the bore of the feed hole of said substrate, and forming in said light transmission layer the feed hole where a bore is bigger than the feed hole of said substrate by piercing said light transmission layer and said substrate, pressurizing the field inside this slitting in the thickness direction by said punching tool, and dividing said light transmission layer in said slitting.
[0023]

(6) Fabricate the circular projection of a bigger outer diameter than the bore of the feed hole of said substrate by said forming cycle to said information recording surface. Said slitting is formed in said light transmission layer along the outside of the periphery of said circular projection. The manufacture approach of the optical recording medium of (5) characterized by forming in said light transmission layer the feed hole where a bore is bigger than the outer diameter of this annular projection while forming an annular projection in the surroundings of the feed hole of said substrate by leaving the periphery section of said circular projection by said punching tool, and piercing said substrate.
[0024]
(7) The manufacture approach of one optical recording medium of (4) - (6) characterized by forming said light transmission layer by rotating this substrate while supplying the resin which has a fluidity near the core of said substrate with said light transmission layer formation process, making said resin flow on the direction outside of a path with a centrifugal force, and spreading.
[0025]
(8) The manufacture approach of the optical recording medium of (7) characterized by establishing the re-exposure process which irradiates a radiation so that said light transmission layer may be in a semi-hardening condition with said light transmission layer formation process by using construction material of said light transmission layer as radiation-curing nature resin, re-irradiates a radiation after said slitting process at the light transmission layer of said semi-hardening condition, and is stiffened thoroughly.
[0026]
(9) A shaping means to fabricate the substrate of the shape of a disk type at least whose one side is an information recording surface, The light transmission layer means forming which forms a light transmission layer thinner than this substrate in said information recording surface, The manufacturing installation of the optical recording medium characterized by coming to contain a slitting means to form circular slitting in this light transmission layer, and a punching means to pierce some [at least] fields inside said slitting, to pierce by the tool, and to form a feed hole in said light transmission layer and said substrate.
[0027]
(10) The optical recording medium of (2) characterized by the amount of projection of said annular projection being larger than the thickness of said light transmission layer.
[0028]
In addition, the bore of the feed hole of a light transmission layer and the outer diameter of the punching tool which pierces a light transmission layer are not necessarily in agreement. For example, when forming slitting of a bigger diameter than the bore of the feed hole of a substrate like the above (5), the punching tool of an outer diameter equal to the inside of the feed hole which it is going to form in a substrate is used. A light transmission layer is pressurized by the punching tool, is pierced, and is divided by slitting of the direction outside of a path rather than the periphery of a tool. Rather than slitting, rather than a punching tool, the direction inside part of a path is pierced also including the part of the direction outside of a path, is further extruded in the thickness direction by the tool, and is removed from an optical recording medium. That is, the feed hole of a light transmission layer is formed with a bigger bore than the outer diameter of a punching tool. On the other hand, if slitting is formed for a diameter equal to the bore of the feed hole of a substrate, it will pierce with the bore of the feed hole of a light transmission layer, and the outer diameter of a tool will be in agreement.
[0029]
Moreover, although the vocabulary a "radiation" means electromagnetic waves, such as the gamma ray and X-ray which are generally emit with breaking of a radioactive element, and alpha rays, and a corpuscular ray, suppose that the vocabulary a "radiation" is use in a meaning call the generic name of the electromagnetic wave which has the property to stiffen the specific resin of a floating condition and corpuscular rays, such as ultraviolet rays and an electron ray, in this description.
[0030]
[Embodiment of the Invention]
Hereafter, the operation gestalt of this invention is explained to a detail with reference to a drawing.

[0031]
Drawing 1 is the sectional view of the optical recording medium 10 concerning this operation gestalt. Drawing 2 is the sectional view showing the punching process at the time of manufacture of an optical recording medium 10.
[0032]
The forming cycle by which the manufacture approach of an optical recording medium 10 fabricates the substrate 12 of the shape of a disk type whose one side is information recording surface 12A, The light transmission layer formation process which forms the light transmission layer 14 thinner than a substrate 12 in information recording surface 12A, It is characterized by coming to contain the slitting process which forms the circular slitting 16 in the light transmission layer 14, and the punching process which pierces the field inside slitting 16, pierces by the tool 18, and forms feed-hole 14A and a feed hole 20 in the light transmission layer 14 and a substrate 12.
[0033]
About other processes, since it is the same as that of the manufacture approach of the conventional optical recording medium, explanation is omitted suitably.
[0034]
First, the forming cycle of a substrate 12 is explained.
[0035]
Resin, such as a polycarbonate which heated beforehand and was fused between the molds (graphic display abbreviation) of a couple, is injected, and it fabricates in the shape of [it is cooled and kept warm, and a diameter does not have 120mm in information recording surface 12A, and a feed hole does not have / in the shape of / thickness in a predetermined molding temperature at 1.1mm] a disk type. Under the present circumstances, detailed predetermined irregularity etc. is formed in information recording surface 12A by La Stampa (graphic display abbreviation) (refer to drawing 3). (graphic display abbreviation) It may replace with a polycarbonate and resin, such as an acrylic and epoxy, may be used. In addition, sign 12B in drawing is the circular crevice fabricated to the field of information recording surface 12A and an opposite hand, in order to make a substrate 12 easy to pierce at the punching process mentioned later, and the bore is fabricated equally to the bore of a feed hole (it forms behind) 20. Thus, a substrate 12 is fabricated, and it removes from a mold, and cools in ordinary temperature, and the stratum functionale is formed in information recording surface 12A at degree process.
[0036]
Here, the formation process of the stratum functionale is explained briefly. In addition, since the stratum functionale is not considered to be the need rather than the light transmission layer 14 especially for grasp of this invention while it is a film further, the graphic display of the stratum functionale is omitted. When an optical recording medium 10 is a type only for playbacks, a reflecting layer is formed in information recording surface 12A as stratum functionale. On the other hand, when optical recording media 10 are record and a refreshable type about information, a reflecting layer and a record layer are formed in information recording surface 12A in this order as stratum functionale. A reflecting layer consists of aluminum, Ag, Au, etc., and is formed with the sputtering method, vacuum deposition, etc. A record layer consists of a phase change ingredient, a coloring matter ingredient, an optical magnetic adjuster, etc., and is formed with the sputtering method, a spin coat method, the ripping method, vacuum deposition, etc.
[0037]
Next, a light transmission layer formation process is explained.
[0038]
The light transmission layer 14 is formed on the stratum functionale with a spin coat method.
[0039]
First, a substrate 12 is arranged horizontally, revolution actuation is carried out, and as shown in drawing 4 , specified quantity supply of the resin 21 of ultraviolet-rays hardenability is carried out from the upper part in the core of a substrate 12. The centrifugal force which is proportional to distance from

the core of a substrate 12 acts on resin 21, and thereby, resin 21 is energized by the direction outside of a path, and is spread by the whole information recording surface 12A. Under the present circumstances, in order that a centrifugal force may hardly act on the resin 21 near the core, the core of a substrate 12 plays a role like ********, and carries out additional supply of the resin 21 continuously on information recording surface 12A. Thereby, as shown in the whole information recording surface 12A at drawing 5 , resin 21 is spread by uniform thickness. A light transmission layer formation process is completed by irradiating resin 21 and making it harden ultraviolet rays after spreading.

[0040]

Next, a slitting process is explained.

[0041]

First, cutting part 22A of a tool 22 is made to contact the position of the light transmission layer 14, as shown in drawing 6 . Cutting part 22A is made to specifically contact the location corresponding to the inner circumference of the feed hole 20 formed behind. If the light transmission layer 14 is rotated with a substrate 12 in this condition as shown in drawing 7 , the circular slitting 16 will be formed in the light transmission layer 14 in the shape of a said alignment. The depth of slitting 16 may be made shallower than the thickness of the light transmission layer 14, and may be made equal to the thickness of the light transmission layer 14. Moreover, it is made deeper than the thickness of the light transmission layer 14, and you may make it even a substrate 12 cut deeply.

[0042]

Next, a punching process is explained.

[0043]

First, the circular punching tool 18 of an outer diameter equal to the bore of the feed hole 20 which it is going to form is prepared, as shown in drawing 2 , it pierces, it pierces so that the periphery of a tool 18 may cut deeply and it may be in agreement with 16, and a tool 18 is made to counter the light transmission layer 14 in the shape of a said alignment. Next, the punching tool 18 is energized in the direction of this light transmission layer 14, and as the light transmission layer 14 and a substrate 12 are pierced, it pierces by the tool 18 and it is shown in drawing 1 , while forming feed-hole 14A in the light transmission layer 14, a feed hole 20 is formed in a substrate 12. In addition, feed-hole 14A and a feed hole 20 have an equal bore.

[0044]

Under the present circumstances, since it pierces in a light transmission layer, cut in it deeply in advance of a process, and slitting by the process is formed in it, and stress concentrates on the part of the slitting 16 of the light transmission layer 14, the light transmission layer 14 is cut deeply and it is divided into accuracy in the part of 16, weld flash does not occur in the inner circumference section of the light transmission layer 14, or the inner circumference section does not exfoliate from information recording surface 12A.

[0045]

An optical recording medium 10 is completed by the above. Since an optical recording medium 10 has the uniform thickness of the light transmission layer 14, while being able to record high-density information on accuracy and being able to reproduce, the inner circumference section sticks to information recording surface 12A certainly, and cannot exfoliate easily, and it is reliable.

[0046]

In addition, although feed-hole 14A of the feed hole 20 of a substrate 12 and the light transmission layer 14 is circular and it is formed in the optical recording medium 10 in the shape of a said alignment, naturally the eccentricity of the some from this circular and strict cardiac condition from which it separated a little from the strict perfect circle configuration is permitted that the precision of the perfect circle of feed holes 20 and 14A and the precision of this alignment should just be in the dimensional tolerance required of an optical recording medium.

[0047]

Next, the 2nd operation gestalt of this invention is explained.

[0048]

Drawing 8 is the sectional view showing the structure of the optical recording medium 30 concerning a **** 2 operation gestalt.

[0049]

The optical recording medium 30 is characterized by forming feed-hole 14A with a bigger bore than the feed hole 20 of a substrate 12 in the light transmission layer 14.

[0050]

Moreover, the manufacture approach of an optical recording medium 30 forms the slitting 16 of the light transmission layer 14 for a bigger diameter than the bore of the feed hole 20 of a substrate 12, as shown in drawing 9 . Pierce the field inside slitting 16, pressurize in the thickness direction by the tool 18, cut the light transmission layer 14 deeply, and it sets to 16. It is characterized by forming feed-hole 14A with a bigger bore than the feed hole 20 of a substrate 12 in the light transmission layer 14 by piercing the light transmission layer 14 and a substrate 12, dividing.

[0051]

About other points, since it is the same as that of the manufacture approach of said optical recording medium 10 and an optical recording medium 10, explanation is omitted suitably.

[0052]

First, a slitting process is explained.

[0053]

As shown in drawing 10 , rather than the location corresponding to the inner circumference of the feed hole 20 behind formed in a substrate 12, cutting part 22A of a tool 22 is made to contact the light transmission layer 14 a little in the location of the outside of the direction of a path, and the light transmission layer 14 is rotated with a substrate 12 in this condition. Thereby, the circular slitting 16 is formed in the light transmission layer 14 in the shape of a said alignment for a bigger diameter a little than the bore of the feed hole 20 behind formed in a substrate 12.

[0054]

Next, a punching process is explained.

[0055]

It pierces so that it may be in agreement with the inner circumference of the feed hole 20 which the periphery of the punching tool 18 tends to form in a substrate 12 first, and a tool 18 is made to counter the light transmission layer 14, as shown in drawing 9 . Next, the punching tool 18 is energized in the direction of the light transmission layer 14, and the feed hole 20 as pierced the light transmission layer 14 and a substrate 12, pierced by the tool 18 and shown in drawing 8 is formed in a substrate 12.

[0056]

Under the present circumstances, the punching tool 18 pressurizes the field inside the slitting 16 in the light transmission layer 14 at a substrate 12 side, cuts the light transmission layer 14 deeply, divides it in 16, and to a substrate 12 side, as it extrudes the inside part of slitting 16, it pierces it.

[0057]

In addition, although the diameter of the slitting 16 in the light transmission layer 14 is larger than the bore of the feed hole 20 of a substrate 12, it cuts deeply, and the inside part of 16 being extruded in the thickness direction by the punching tool 18, and forming the feed hole 20 of a substrate 12, this feed hole 20 is inserted in and it is removed. Moreover, crevice (roll off) 18A to which it can pierce to the cutting part peripheral face of a punching tool inside slitting, and the light transmission layer outside a tool (the shape of a ring) can enter into it is prepared, and you may enable it to remove the light transmission layer of the part concerned efficiently.

[0058]

Thereby, feed-hole 14A with a larger bore than the feed hole 20 of a substrate 12 is formed in the light transmission layer 14.

[0059]

In addition, since it pierces in a light transmission layer, cut in it deeply in advance of a process, and slitting by the process is formed in it also in this case, and stress concentrates on the part of the slitting 16 of the light transmission layer 14, the light transmission layer 14 is cut deeply and it is divided into

accuracy in the part of 16, weld flash does not occur in the inner circumference section of the light transmission layer 14, or the inner circumference section does not exfoliate from information recording surface 12A.

[0060]

Thus, by making feed-hole 14A of the light transmission layer 14 larger than the feed hole 20 of a substrate 12, even if it inserts a finger in a feed hole 20, it is hard coming to touch the inner circumference section of the light transmission layer 14 directly a finger, and exfoliation of the light transmission layer 14 by human handling can also be prevented.

[0061]

Similarly, when loading an information recording device, an information regenerative apparatus, etc. with an optical recording medium 30, exfoliation of the light transmission layer 14 at the time of the components for positioning etc. not contacting the inner circumference section of the light transmission layer 14, and using it with these equipments can also be prevented.

[0062]

Moreover, although there is a difference in the bore of the feed hole 20 of a substrate 12, and the bore of feed-hole 14A of the light transmission layer 14, two feed holes 20 and 14A can be formed by 1 time of punching by the punching tool 18 by forming slitting 16, and productive efficiency is good.

[0063]

In addition, naturally the eccentricity of the some from this circular and strict cardiac condition from which it separated a little from the strict perfect circle is permitted like said 1st operation gestalt that the precision of the perfect circle of the feed hole 20 of a substrate 12 and the precision of this alignment over an optical recording medium 30 should just be in the dimensional tolerance required of an optical recording medium 30.

[0064]

Moreover, that feed-hole 14A of the light transmission layer 14 should just be formed so that inner circumference may be located in the direction outside of a path rather than the feed hole 20 of a substrate 12, the precision of a perfect circle required of feed-hole 14A of the light transmission layer 14 and the precision of this alignment over an optical recording medium 30 need to be lower than the precision required of the feed hole 20 of a substrate 12, and do not necessarily need to be the feed hole 20 and this alignment of a substrate 12. That is, the precision required of formation of slitting 16 is low, and a slitting activity is so easy. Moreover, it is necessary to pierce in the case of punching and to cut deeply with a tool 18 that the punching tool 18 is deeply cut so that it may be in agreement with the feed hole 20 which it is going to form in a substrate 12, and it should just pierce the field inside 16, and 16 does not necessarily need to be in this cardiac condition.

[0065]

Next, the 3rd operation gestalt of this invention is explained.

[0066]

Drawing 11 is the sectional view showing the structure of the optical recording medium 40 concerning a **** 3 operation gestalt.

[0067]

The optical recording medium 40 is characterized by forming feed-hole 44A with a bigger bore than the outer diameter of the annular projection 48 in the light transmission layer 44 while the annular projection 48 which projects in the thickness direction is formed in the surroundings of the feed hole 50 of a substrate 42.

[0068]

As shown in drawing 12 , moreover, the manufacture approach of an optical recording medium 40 The circular projection 43 of a bigger outer diameter than the bore of the feed hole 50 of the substrate 42 behind formed by the forming cycle is fabricated to information recording surface 42A. Cut deeply in the light transmission layer 44 along the outside of the periphery of the circular projection 43, and 46 is formed. While forming the annular projection 48 in a substrate 42 around a feed hole 50 and a feed hole 50 by leaving the periphery section of the circular projection 43 by the punching tool 18, and piercing a

substrate 42, it is characterized by forming feed-hole 44A with a bigger bore than the outer diameter of this annular projection 48 in the light transmission layer 44.

[0069]

About other points, since it is the same as that of the manufacture approach of said optical recording media 10 and 30 and these optical recording media, explanation is omitted suitably.

[0070]

First, the forming cycle of a substrate 42 is explained.

[0071]

The circular projection 43 as shown in the information recording surface 42A side of a substrate 42 at drawing 13 is formed by establishing the circular crevice in the core of the mold which fabricates information recording surface 42A among the molds (graphic display abbreviation) of the couple which fabricates a substrate 42. The circular projection 43 is fabricated in the shape of a said alignment so that it may become a big outer diameter a little from the bore of the feed hole 50 formed behind. In addition, the thickness of parts other than circular projection 43 fabricates a substrate 42 so that 1.1mm and the amount of projection of the circular projection 43 may be set to 0.1mm. Moreover, the circular projection is prepared in the core of the mold which fabricates the field of information recording surface 42A of a substrate 42, and an opposite hand, and information recording surface 42A of a substrate 42 and crevice 42B circular to an opposite hand are fabricated in the shape of a said alignment. In addition, circular crevice 42B is fabricated so that a bore may become equal to the bore of the feed hole 50 formed behind.

[0072]

Next, the formation process of the light transmission layer 44 is explained.

[0073]

First, a substrate 42 is arranged horizontally, revolution actuation is carried out, and specified quantity supply of the ultraviolet-rays hardenability resin is carried out from the upper part in the core of this substrate 42. The centrifugal force which is proportional to distance from the core of a substrate 42 acts on the supplied resin, and it is energized by the direction outside of a path, and is spread by the whole information recording surface 42A. Under the present circumstances, in order that a centrifugal force may hardly act on the resin near the center of rotation, the core of a substrate 42 plays a role like ********, and carries out additional supply of the resin continuously on information recording surface 42A. Thereby, as shown in drawing 14 , resin is spread by the whole information recording surface 42A by uniform thickness. In addition, since resin is spread by uniform thickness also on the circular projection 43, the light transmission layer 44 is formed a ** with a stage. After spreading, irradiate resin, it is made to harden ultraviolet rays and the formation process of the light transmission layer 44 is completed.

[0074]

Next, a slitting process is explained.

[0075]

As shown in drawing 15 , slitting 46 is formed near the level difference part of the light transmission layer 44 so that the outside of the periphery of the circular projection 43 may be met. In addition, since it is the same as said 1st and 2nd operation gestalt about the tool which forms slitting 46, explanation is omitted.

[0076]

Next, a punching process is explained.

[0077]

First, it pierces so that it may be in agreement with the inner circumference of the feed hole 50 which the periphery of the punching tool 18 tends to form, and a tool 18 is made to counter the light transmission layer 44, as shown in drawing 12 . Next, the punching tool 18 is energized in the direction of the light transmission layer 44, it leaves the periphery section and the circular projection 43 is pierced, while forming the feed hole 50 as shown in drawing 11 , it leaves a part of circular projection 43, and the annular projection 48 is formed in the surroundings of a feed hole 50.

[0078]
Under the present circumstances, the punching tool 18 pressurizes in the thickness direction, cuts the light transmission layer 44 on the circular projection 43 deeply, divides it in 46, and it is pierced so that the inside part of slitting 46 may be extruded to a substrate 42 side. Thereby, feed-hole 44A with a bigger bore than the outer diameter of the annular projection 48 is formed in the light transmission layer 44.
[0079]
Since it pierces in a light transmission layer, cut in it deeply in advance of a process, and slitting by the process is formed in it also in this case, and stress concentrates on the part of the slitting 46 of the light transmission layer 44, the light transmission layer 44 is cut deeply and it is divided into accuracy in the part of 46, weld flash does not occur in the inner circumference section of the light transmission layer 44, or the inner circumference section does not exfoliate from information recording surface 42A.
[0080]
That is, like said optical recording media 10 and 30, the thickness of the light transmission layer 44 is uniform, the inner circumference section of the light transmission layer 44 sticks to information recording surface 42A certainly, and cannot exfoliate easily, and an optical recording medium 40 is reliable while it can record and reproduce information at accuracy.
[0081]
Furthermore, since the annular projection 48 is formed inside the inner circumference section of the light transmission layer 44, even if it inserts a finger in a feed hole 50, a finger cannot touch the inner circumference section of the light transmission layer 44 directly, and exfoliation of the light transmission layer 44 by human handling can also be prevented certainly.
[0082]
Similarly, when loading an information recording device, an information regenerative apparatus, etc. with an optical recording medium 40, exfoliation of the light transmission layer 44 at the time of the components for positioning etc. not contacting the inner circumference section of the light transmission layer 44, and using it with these equipments etc. can also be prevented certainly.
[0083]
That is, since the inner circumference section of the light transmission layer 44 is protected by the annular projection 48, exfoliation of the light transmission layer 44 can be prevented certainly.
[0084]
Moreover, although there is a difference in the bore of the feed hole 50 of a substrate 42, and the bore of feed-hole 44A of the light transmission layer 44, two feed holes 50 and 44A and the annular projection 48 can be formed by 1 time of punching by the punching tool 18 by forming slitting 46, and productive efficiency is good.
[0085]
In addition, the annular projection 48 does not necessarily need to have [that what is necessary is just to project in the thickness direction around the feed hole 50 of a substrate 42] the fixed width of face of the direction of a path. That is, the periphery of the annular projection 48 does not need to be the round shape of an optical recording medium 40 and this alignment. Therefore, in the forming cycle of a substrate 42, eccentricity of the circular projection 43 may be carried out a little, and you may form.
[0086]
Moreover, feed-hole 44A of the light transmission layer 44 does not need to be the round shape of an optical recording medium 40 and this alignment that what is necessary is to just be formed so that inner circumference may be located in the direction outside of a path rather than the annular projection 48. Therefore, slitting which was cut deeply and carried out eccentricity to the light transmission layer 44 a little also at the process may be formed.
[0087]
Moreover, in said the 1st - 3rd operation gestalt, although the optical recording medium is considered as the one side type which can record information only on one side, this invention is not limited to this and, naturally this invention can be applied also to the optical recording medium of the double-sided type

which can record information on both sides. In this case, thickness can consider as the optical recording medium which is 1.2mm by setting thickness of a substrate to 1.0mm and carrying out the laminating of the 0.1mm light transmission layer to both sides of a substrate. Or thickness prepares two things which carried out the laminating of the light transmission layer which is 0.1mm, and may stick substrate sides on the substrate whose thickness is 0.5mm. Furthermore, two or more record layers can apply this invention also to the optical recording medium formed in one side or both sides.

[0088]

Moreover, although it cuts deeply in the light transmission layers 14 and 44 and 16 and 46 are formed after irradiating ultraviolet rays to the resin spread with the formation process of the light transmission layers 14 and 44 in said the 1st - 3rd operation gestalt and making it harden thoroughly This invention makes the spread resin a semi-hardening condition, and after it forms slitting 16 and 46, you may make it stiffen thoroughly the resin which re-irradiated ultraviolet rays and spread them by not being limited to to this and controlling the irradiation time of ultraviolet rays etc. by the formation process of the light transmission layers 14 and 44 suitably.

[0089]

When making a cutting edge contact the light transmission layers 14 and 44, cutting deeply and forming 16 and 46, although it can extend a little in the thickness direction of a cutting edge, if the light transmission layers 14 and 44 are in a semi-hardening condition, easily, it can follow, and the light transmission layers 14 and 44 can deform in the thickness direction of a cutting edge, and can prevent the exfoliation from substrates 12 and 42 certainly.

[0090]

As for the degree of the semi-hardening of the spread resin, it is desirable that it is the hardness which is extent with which resin does not adhere to a cutting edge, and is the softness which is extent which slitting of a cutting edge is followed, and resin follows and deforms in the thickness direction of a cutting edge easily, and does not exfoliate from an interface with a substrate.

[0091]

In addition, in order to pierce certainly the inside part of slitting in a light transmission layer and to remove it, it is desirable to pierce and to stiffen a light transmission layer thoroughly before a process.

[0092]

Moreover, in said the 1st - 3rd operation gestalt, although a light transmission layer is resin of ultraviolet-rays hardenability, it may use the resin of the property hardened with the radiation of other classes, such as resin of electron ray hardenability.

[0093]

Moreover, in said the 1st - 3rd operation gestalt, although the light transmission layer is formed in a substrate with the spin coat method, this invention is not limited to this and may form a light transmission layer in a substrate by sticking the sheet-like ingredient of light transmission nature on a substrate for example. Furthermore, a light transmission layer may be formed in a substrate by other approaches, such as a doctor blade method.

[0094]

Moreover, in said the 1st - 3rd operation gestalt, slitting may be formed in a light transmission layer by making a tool contact a light transmission layer, not limiting this invention to this, fixing a substrate and a light transmission layer, and moving a tool in a circular orbit, although slitting is formed by rotating a light transmission layer with a substrate. Moreover, it may replace with a tool and slitting may be formed using a laser beam. Moreover, as shown, for example in drawing 16 , the pressure welding of the edge of the cylindrical tool 60 may be carried out to a light transmission layer, and slitting 16 (46) may be formed.

[0095]

Moreover, although an optical recording medium is pierced, it pierces from a light transmission layer side to a substrate side by the tool in a punching process in said the 1st - 3rd operation gestalt and the feed hole is formed This invention is not what is limited to this. When the depth of slitting is enough etc., When the force of a direction of exfoliating from the information recording surface which acts on a

light transmission layer by punching is small, as shown in drawing 17 , an optical recording medium may be pierced from a substrate 12 (42) side to the light transmission layer 14 (44) side, it may pierce by the tool, and a feed hole may be formed. When the force of a direction of on the other hand exfoliating from the information recording surface which acts on a light transmission layer by punching when slitting is shallow is large, it is desirable to pierce an optical recording medium from a light transmission layer side to a substrate side, to pierce by the tool like said the 1st - 3rd operation gestalt, and to form a feed hole.

[0096]

Moreover, although the circular crevices 12B and 42B are fabricated by the forming cycle, substrates 12 and 42 are not limited to this, and this invention fabricates a substrate in the shape of [without a circular crevice] a disk type, and you may make it pierce it in said the 1st - 3rd operation gestalt, when punching of substrates 12 and 42 is easy.

[0097]

Moreover, in said 3rd operation gestalt, although the amount of projection of the annular projection 48 is 0.1mm equal to the thickness of the light transmission layer 44, this invention is not limited to this and may make the amount of projection of the annular projection 44 larger than the thickness of the light transmission layer 44. By doing in this way, when it is [optical recording medium / 40] sufficient in two or more [-fold] and lays an optical recording medium 40 in base superiors, the light transmission layer 44 can prevent contacting other optical recording media, a base, etc., and can protect the light transmission layer 44. In addition, although the light transmission layer 44 can contact other optical recording media etc. if an optical recording medium 40 inclines a little, contact pressure can be mitigated also in this case and the fixed effectiveness of protecting the light transmission layer 44 can be expected.

[0098]

In addition, also when the amount of projection of the annular projection 44 is smaller than the thickness of the light transmission layer 44, the fixed effectiveness that the annular projection 44 protects the inner circumference section of the light transmission layer 44 from a finger, positioning components, etc. is acquired.

[0099]

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view showing the structure of the optical recording medium concerning the 1st operation gestalt of this invention
[Drawing 2] The sectional view showing the punching process of this optical recording medium
[Drawing 3] The sectional view showing the forming cycle of the substrate of this optical recording medium
[Drawing 4] The sectional view showing spreading of the resin in the formation process of the optical recording layer of this optical recording medium
[Drawing 5] The sectional view showing the optical recording layer formed of the homeoplasia process
[Drawing 6] The sectional view showing the slitting process of this optical recording medium
[Drawing 7] This perspective view
[Drawing 8] The sectional view showing the structure of the optical recording medium concerning the 2nd operation gestalt of this invention
[Drawing 9] The sectional view showing the punching process of this optical recording medium
[Drawing 10] The sectional view showing the slitting process of this optical recording medium
[Drawing 11] The sectional view showing the structure of the optical recording medium concerning the 3rd operation gestalt of this invention
[Drawing 12] The sectional view showing the punching process of this optical recording medium
[Drawing 13] The sectional view showing the forming cycle of the substrate of this optical recording medium
[Drawing 14] The sectional view showing the formation process of the optical recording layer of this optical recording medium
[Drawing 15] The sectional view showing the slitting process of this optical recording medium
[Drawing 16] The sectional view showing the slitting process concerning other operation gestalten of this invention
[Drawing 17] The sectional view showing the punching process concerning other operation gestalten of this invention
[Drawing 18] The perspective view showing the structure of the conventional optical recording medium
[Drawing 19] The sectional view showing the punching process of this optical recording medium
[Drawing 20] The sectional view showing the weld flash of the inner circumference section of the light transmission layer by this punching process
[Description of Notations]
10, 30, 40,100 -- Optical recording medium
12 42,102 -- Substrate
12A, 42A, 102A -- Information recording surface
14 44,104 -- Light transmission layer
16 46 -- Slitting
18 -- Punching tool

14A, 20, 44A, 50 -- Feed hole
43 -- Circular projection
48 -- Annular projection

[Translation done.]

* NOTICES *

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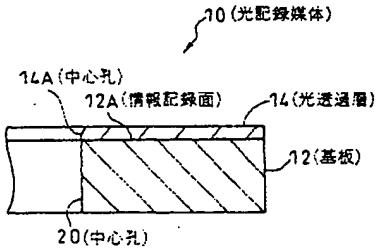
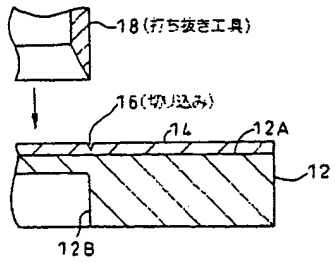
DRAWINGS

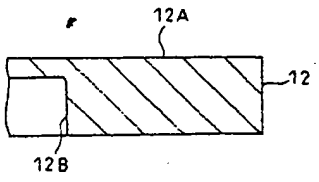
[Drawing 1]



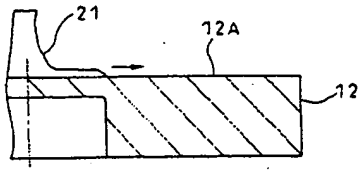
[Drawing 2]



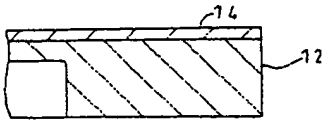
[Drawing 3]



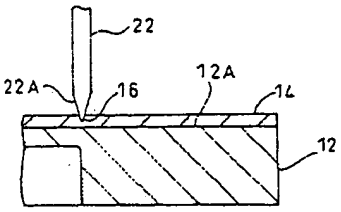
[Drawing 4]



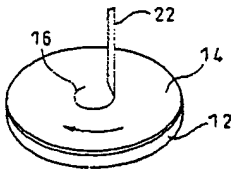
[Drawing 5]



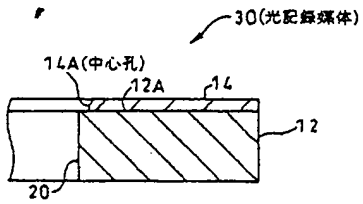
[Drawing 6]



[Drawing 7]



[Drawing 8]



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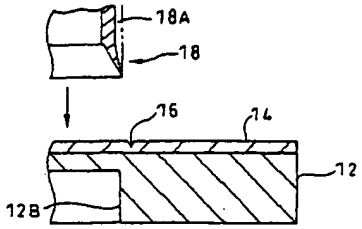
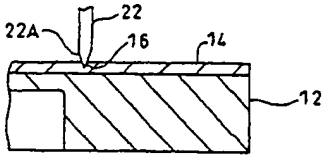
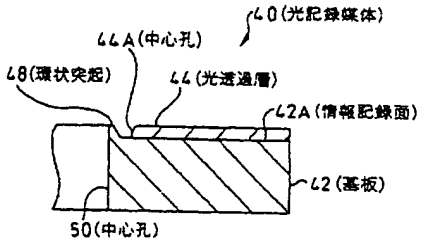


[Drawing 10]



[Drawing 11]



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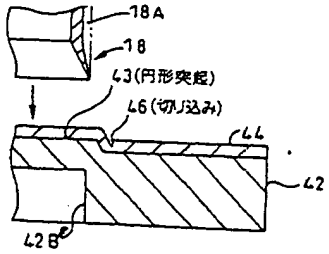

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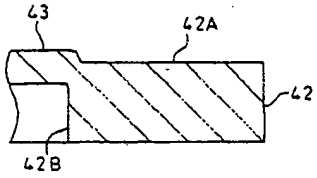

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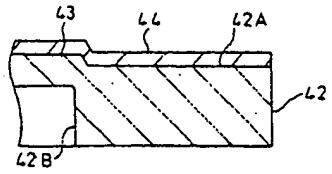

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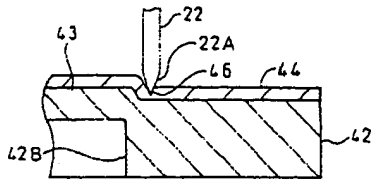
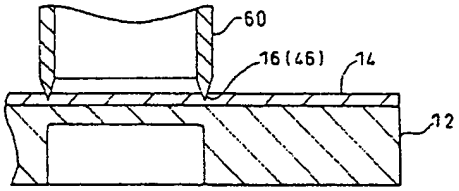
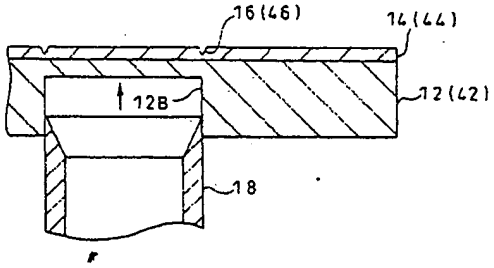


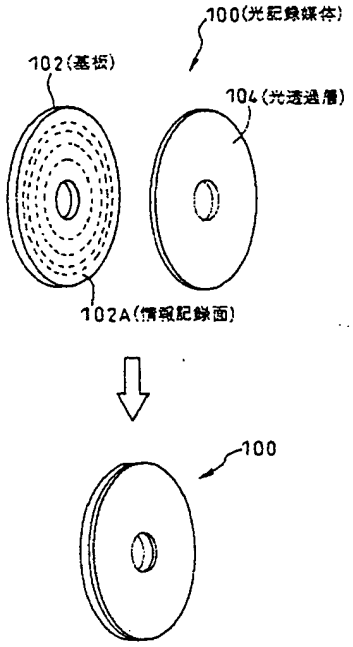
[Drawing 16]



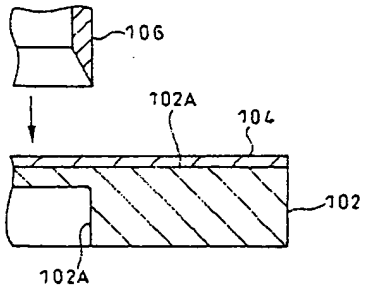
[Drawing 17]



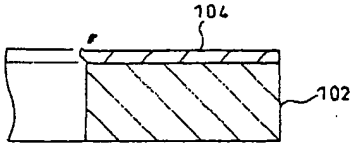
[Drawing 18]



[Drawing 19]



[Drawing 20]



[Translation done.]